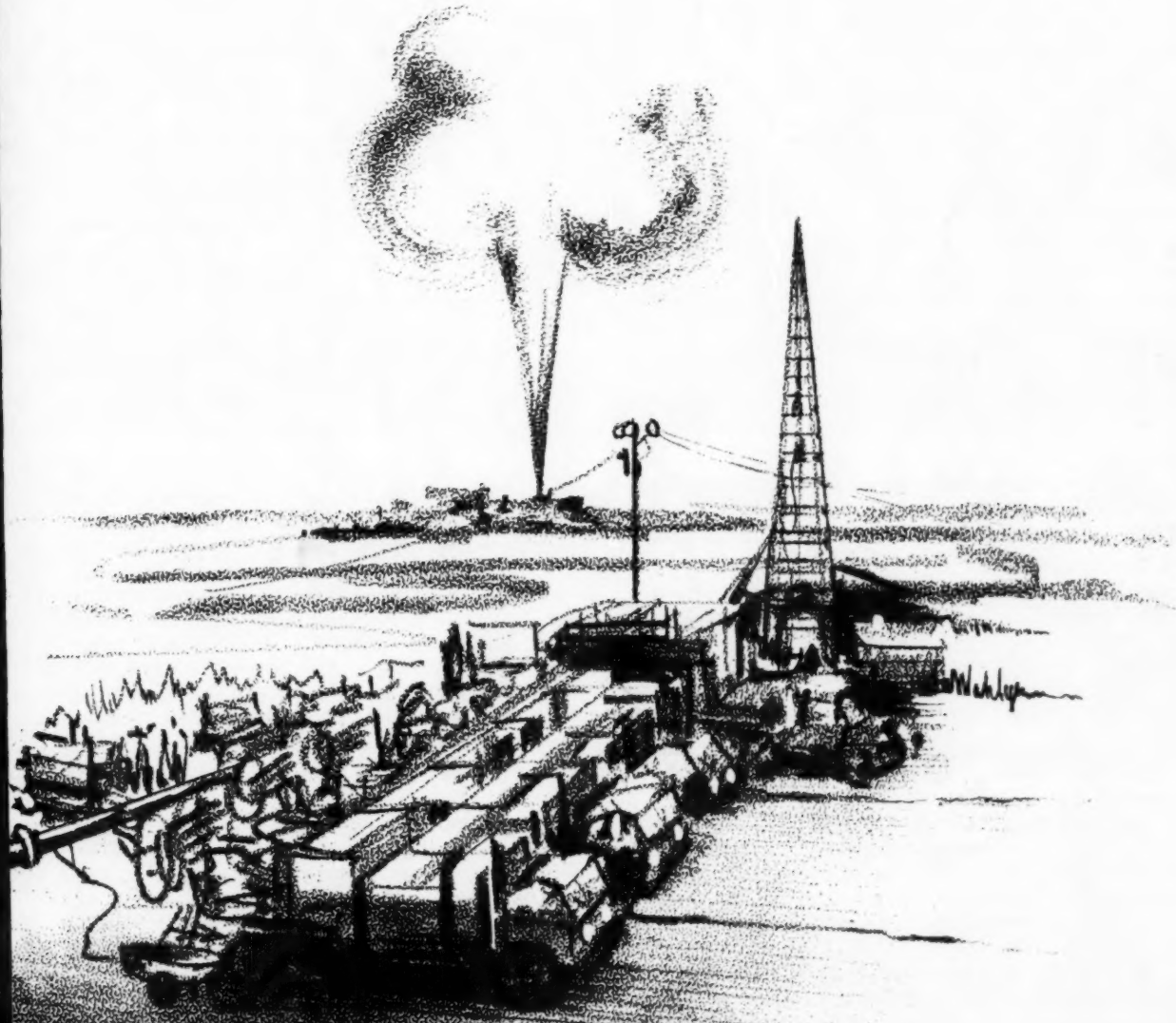
diesel power

May 1961

oem es

geared to the original equipment manufacturers
and equipment superintendents in the field



POWER for oil well servicing

TEXACO DIESEL DATA

HOW TO SPOT FUEL INJECTOR PROBLEMS

The fuel injector is a most important and complex part of a diesel engine. The effects of a badly adjusted fuel injector can run all the way from increased fuel and lubricant consumption to ring and bearing failures.

Here are some of the characteristic symptoms you'll get if your fuel injector is acting up, and what the most likely cause of each symptom is.

1. Symptom: Heavy black smoke at exhaust; loss of power; rough idling.
Probable Cause: Incomplete combustion, due to worn injector nozzle.

2. Symptom: Rough, noisy engine; stuck or broken rings; bearing failure in most severe instances.
Probable Cause: Pre-ignition, resulting from premature fuel injection. Causes extreme high temperatures and pressures in combustion chamber.

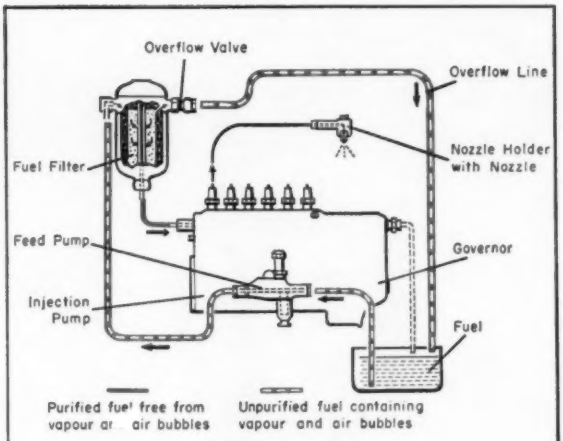
3. Symptom: Smoky exhaust; heavy soot deposits in engine and crankcase oil.
Probable Cause: Incomplete combustion due to late injection.

4. Symptom: Premature ring wear in some cylinders, heavy varnish formation in other cylinders; engine sounds uneven under load; white or light-blue smoke when engine is idling; dilution of lube oil.
Probable Cause: Improperly equalized injectors, which pump too much fuel into certain cylinders, starve others. "Over-fed" cylinders do most of the work.

Some of these symptoms can be cured with a comparatively minor adjustment; others require more involved techniques.

Improperly equalized injectors, especially on large engines, can be double-checked by a speed-drop test. This involves cutting out one cylinder at a time while you're checking the engine speed with a tachometer. The speed will fall off the most when you cut out the cylinders that are getting the most fuel.

Some folks try to get more power out of an engine by injecting more fuel than the engine was designed to take. You do get more power this way, but it's at the expense of your rings and bearings, and the exhaust becomes excessively smoky. The following chart shows the increase of ring temperature and exhaust smoke on a 4-cycle diesel experimentally overloaded with fuel:



Fuel Circulation in a Fuel Injection System

Fuel/Air ratio	% rated load	BMEP	% exhaust smoke*	Ring groove temperature
.03	67	51	7	336
.04	100	76	7	372
.05	112	85	16	396
.06	114	87	69	402
.07	113	86	92	397
.08	111	84	97	388

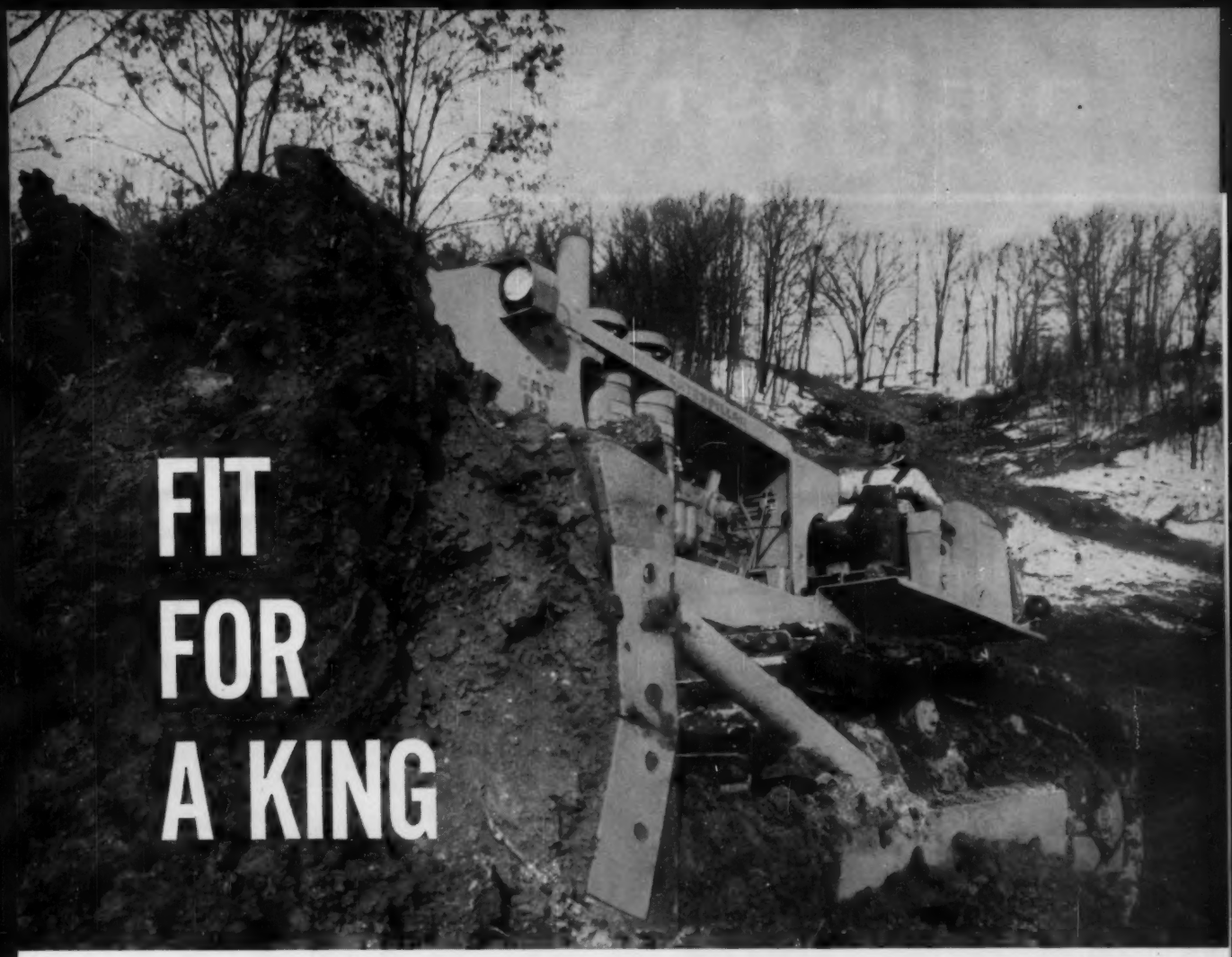
*Smokemeter reading.

Because a fuel injector is as carefully built as a good watch, it's best to let your manufacturer's service organization help you out with maintenance and repair problems. The most valuable type of preventive maintenance the diesel operator can do is to keep the injector clean. That means no disassembling of the unit in a dusty or otherwise contaminated atmosphere. It also means that you must use nothing but *clean* fuel. Contaminated fuel can ruin a fuel injector nozzle within a few days. You have to be particularly cautious if your injector isn't equipped with a dependable fuel filter. Water in the fuel is objectionable too, not only because it gives uneven engine operation but because it promotes corrosion of valve parts.

Fuel injector problems are best handled by trained experts. The same is true of diesel fuel and lubrication problems. Texaco has many, many years' experience in fueling and lubricating diesel engines of all sizes, in all types of operations. If you're having a problem with diesel fuel or lubricants, contact Texaco Inc., 135 East 42nd Street, New York 17, N. Y.

TEXACO

Throughout the United States
Canada • Latin America • West Africa

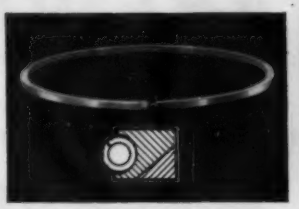


Caterpillar selects Koppers piston and sealing rings for use in the world's largest single engine crawler tractor.

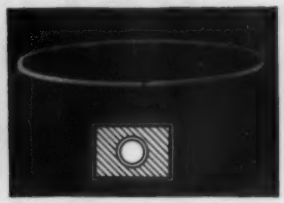
A brute of a tractor for brute force jobs, Caterpillar's D9 Series E Tractor applies a 335 HP engine which combines the versatility and economy of diesel power with the power boosting efficiency of a turbocharger. Traditional Caterpillar durability is built into every part. And in the power shift transmission sealing rings, chrome plated malleable iron compression rings, crankshaft seals, and steering control seals, that durability spells K-O-P-P-E-R-S.

Says Caterpillar: "The D9 Tractor is ruggedly built for long life under the most severe operating conditions. In addition, special attention has been given to insure the production of a power plant that is easy and economical to operate and maintain. On all these counts, the Koppers rings and seals we have selected meet our requirements of quality and dependability."

Write today for 8 page brochure on metallic sealing rings to: KOPPERS COMPANY, INC., Piston and Sealing Ring Department, 6405 Hamburg Street, Baltimore 3, Maryland.

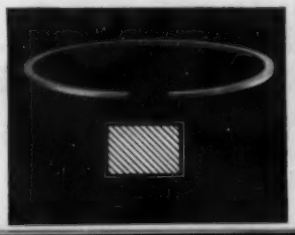


CRANKSHAFT SEALS: Application of a conformable step seal ring (specially designed for Caterpillar) establishes a *permanent* crankshaft seal, reliable for the life of the engine.

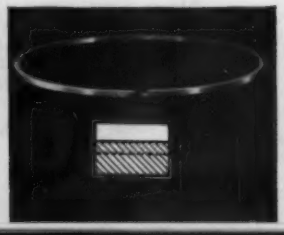


TRANSMISSION SEALING RINGS: Specially designed metallic sealing rings transmit fluid power to the rotor and actuate the clutches of Caterpillar's dramatic new power shift transmission.

COMPRESSION RINGS: Dependable performance at the most critical point in the combustion chamber is assured by chrome plated malleable iron rings.



STEERING CONTROL SEALS: Caterpillar's new design steering control requires a rotating, high pressure seal. Piston ring type seals establish simplicity, reliability.



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NATURAL GAS CONVERSION

FOR GENERAL MOTORS SERIES 71 DIESEL ENGINES

WHY DO WE SAY IT'S THE MOST SIGNIFICANT ENGINE NEWS IN A CENTURY?

BECAUSE

For years there has been a growing demand for a true spark ignited, natural gas burning engine with the flexibility and superior performance characteristic of the General Motors Two Cycle Diesel Engine.

The development by Stewart & Stevenson Services of a Spark Ignition Conversion Kit for this great Diesel Engine offers a world of new advantages to prospective engine users as well as the owners of existing General Motors Diesel applications wherever lower cost, natural gas is available.

Now, you can enjoy **"Jimmy Diesel"** performance, long life and flexibility PLUS the advantage of being able to operate (through a simple conversion) on either Diesel fuel or straight natural gas . . . **WITHOUT OWNING TWO TYPES OF ENGINES.**

General Motors Series 71 Engines equipped with the new Stewart & Stevenson Spark Ignition Conversion operate on natural gas fuel developing full rated horsepower. Furthermore, their acceleration and lugging characteristics are simply amazing.

These new engines equipped for natural gas operation as well as the conversion kits available for older series 71 engines are thoroughly **TRIED AND PROVEN.**

They are the result of thousands of hours of exhaustive research and field testing over a period of more than three years.

Write today for more information on how these new Stewart & Stevenson Services developments can benefit you.

ENGINE NEWS IN A CENTURY

12 NEW SPARK-IGNITED MODELS

FROM 50 H.P. TO 1440 H.P.

MODEL 3SG
Horsepower.....50 to 76
Number of Cylinders.....3
RPM (Continuous Duty).....
.....1200 to 1800
Weight....1600 lbs., approx.

MODEL 4SG
Horsepower.....63 to 107
Number of Cylinders.....4
RPM (Continuous Duty).....
.....1200 to 1800
Weight....1800 lbs., approx.

MODEL 6SG
Horsepower.....100 to 163
Number of Cylinders.....6
RPM (Continuous Duty).....
.....1200 to 1800
Weight....2150 lbs., approx.

MODEL TWIN 4SG
Horsepower.....125 to 212
Number of Cylinders.....8
RPM (Continuous Duty).....
.....1200 to 1800
Weight....5000 lbs., approx.

MODEL 8VSG
Horsepower.....135 to 250
Number of Cylinders.....8
RPM (Continuous Duty).....
.....1200 to 1800
Weight....2550 lbs., approx.

MODEL TWIN 6SG
Horsepower.....200 to 326
Number of Cylinders.....12
RPM (Continuous Duty).....
.....1200 to 1800
Weight....5700 lbs., approx.

MODEL 12VSG
Horsepower.....200 to 360
Number of Cylinders.....12
RPM (Continuous Duty).....
.....1200 to 1800
Weight....3300 lbs., approx.

MODEL 16VSG
Horsepower.....275 to 500
Number of Cylinders.....16
RPM (Continuous Duty).....
.....1200 to 1800
Weight....5800 lbs., approx.

MODEL QUAD 6SG
Horsepower.....400 to 650
Number of Cylinders.....24
RPM (Continuous Duty).....
.....1200 to 1800
Weight..12500 lbs., approx.

MODEL TWIN 12VSG
Horsepower.....400 to 720
Number of Cylinders.....24
RPM (Continuous Duty).....
.....1200 to 1800
Weight..13500 lbs., approx.

MODEL TWIN 16VSG
Horsepower....550 to 1000
Number of Cylinders.....32
RPM (Continuous Duty).....
.....1200 to 1800
Weight..17800 lbs., approx.

MODEL QUAD 12VSG
Horsepower....800 to 1440
Number of Cylinders.....48
RPM (Continuous Duty).....
.....1200 to 1800
Weight..26000 lbs., approx.

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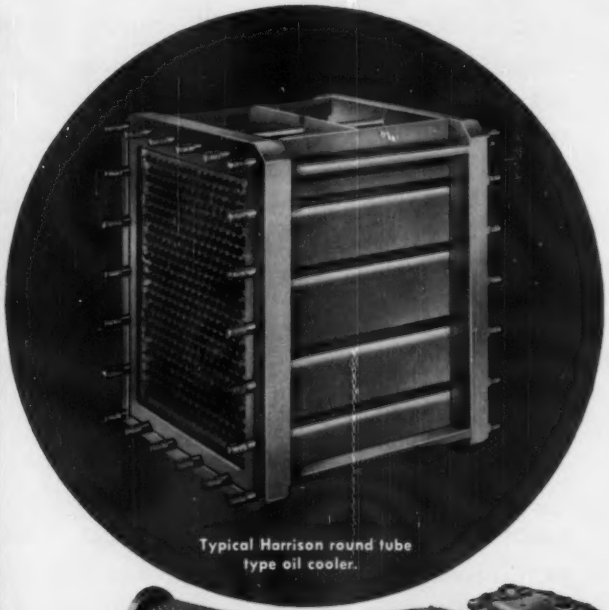
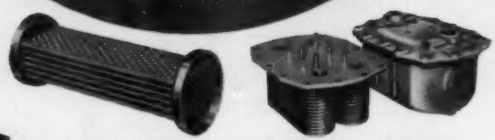
HARRISON HEAT EXCHANGERS RELIABLY CONTROL VITAL OIL TEMPERATURE ON DIESEL-POWERED ZEPHYRCRANE

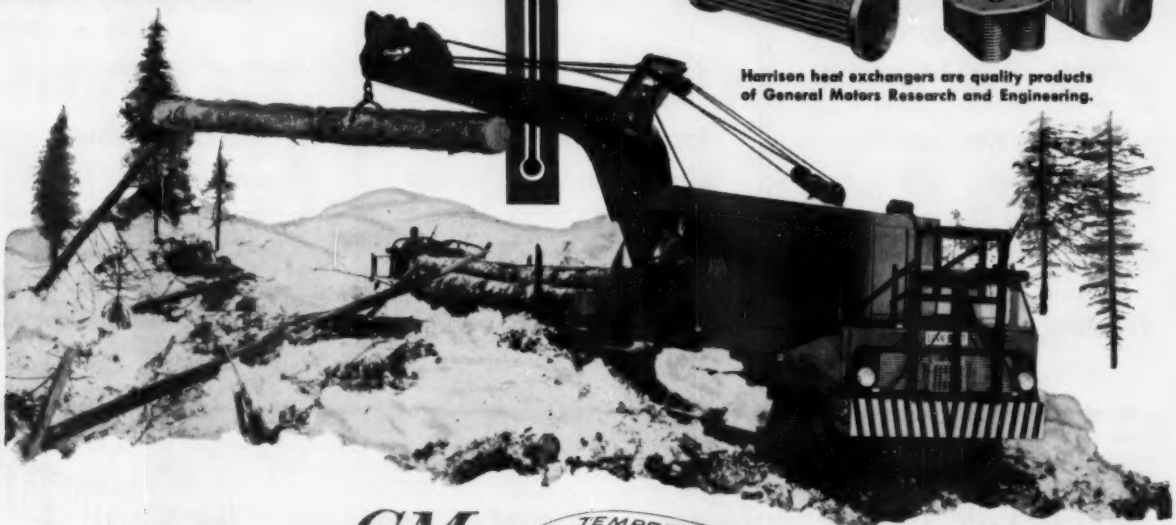
Paul Bunyan would be amazed at the performance of this Link-Belt log loader in the rugged timberland north of Columbia Falls, Montana. It will load an average of 60,000-board feet each 8-hour day in the winter . . . even more in the summer! To keep the oil cool in the crane's powerful GM Diesel engine—that's a job for reliable Harrison oil coolers. Like all Harrison heat exchangers, they're equipped with our own kind of reliability—"measurable excellence"—your assurance that Harrison heat transfer products will perform exactly as planned. You will find this reliability in a wide range of basic types of Harrison heat transfer construction—a complete line of designs from which to select the *right* heat exchanger for your particular application. To save time and money on your temperature control problems, call in a Harrison Sales Engineer at the design stage.



Typical Harrison round tube type oil cooler.



Harrison heat exchangers are quality products of General Motors Research and Engineering.



Free For an informative 48-page brochure on the complete Harrison line . . . write to Department 902

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AIRCRAFT, AUTOMOTIVE, MARINE AND INDUSTRIAL HEAT EXCHANGERS

HARRISON RADIATOR DIVISION, GENERAL MOTORS CORPORATION, LOCKPORT, NEW YORK

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diesel power

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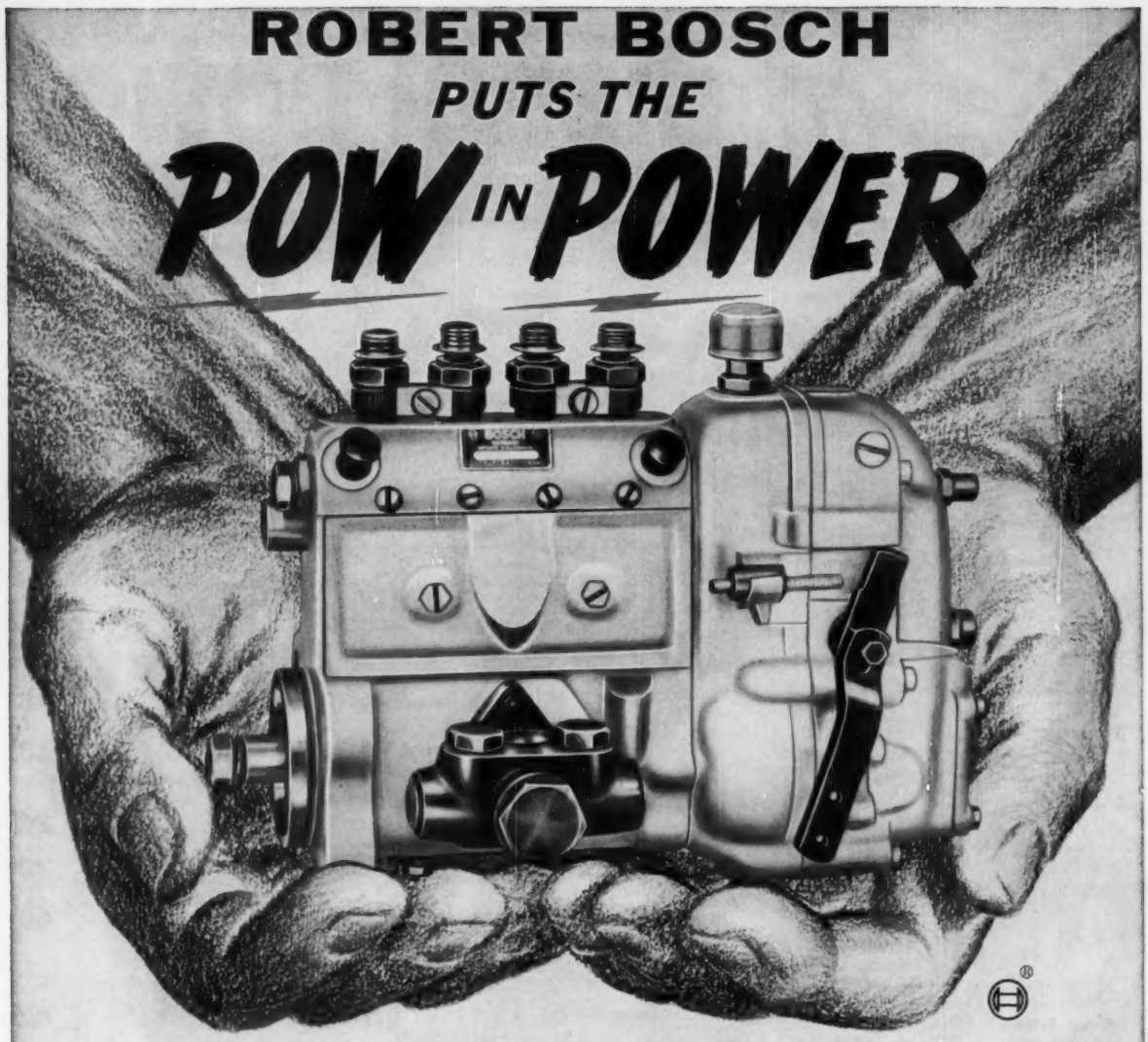

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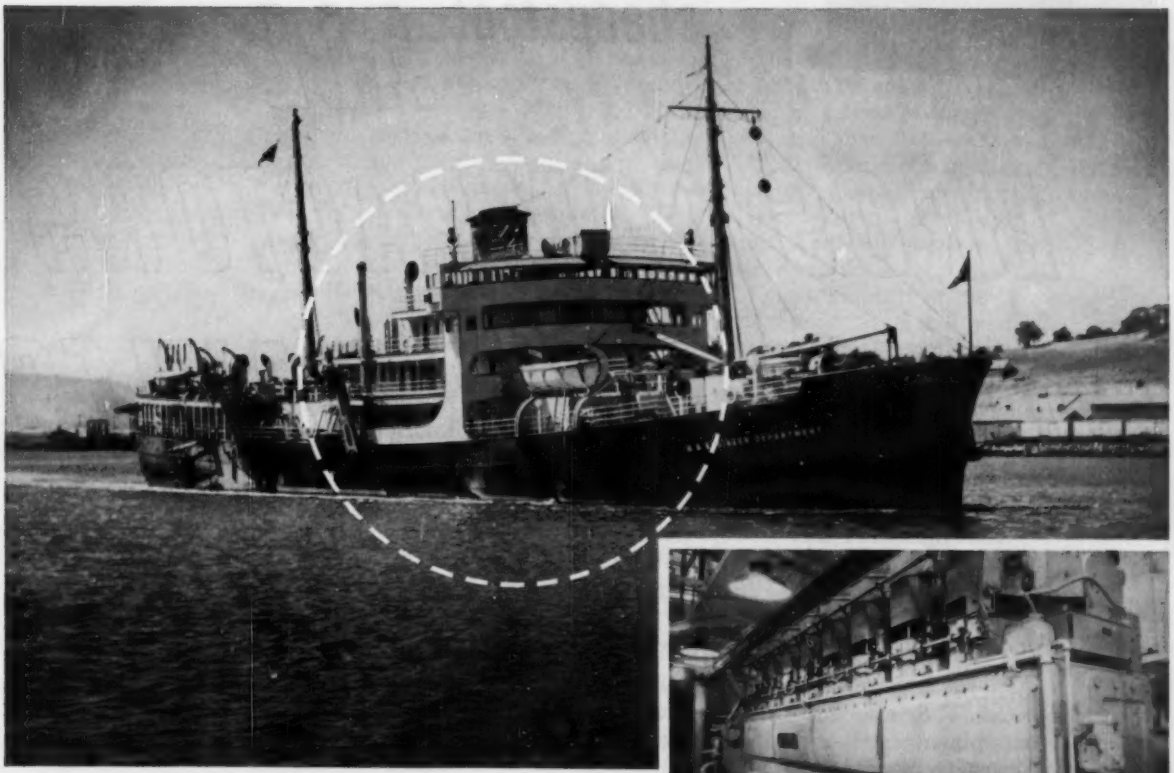
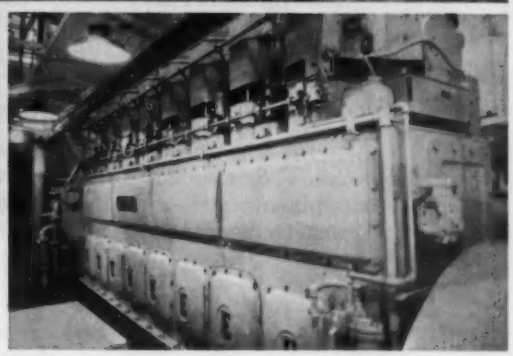
CHESTER HARDING

For more speed, more loads, and lower cost, U.S. Army Corps of Engineers repowered seagoing hopper-dredge "Chester Harding" with heavy duty Enterprise marine diesels, and direct-driven, reversible propellers. These Enterprise Diesels are required to operate at 110% load, at rated speed, for a minimum of two hours in any 24 hour operating period. Rated shaft horsepower of 2,000 on each propeller at 190 rpm drives the vessel at 12.65 knots, light load, and 11.01 knots, full load. Speed before repowering was 7.5 knots, maximum. It is now possible to utilize full engine hp under any varying load conditions.

To step up efficiency and performance with maximum economy, repower with dependable heavy-duty Enterprise Diesels. Call us, or write for full data and project recommendations.



Veteran dredge repowered with Enterprise Diesels by Puget Sound Bridge & Dredging Co., Seattle.



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"Well-engineered and trouble-free," is the way A. O. Williamson, Manager of Bros' Road Machinery Division, describes Clark Axles. "And Clark," he continues, "*because of its broad standard line* (planetary, steering, trailer and bogie axles, 1500 to 180,000 lb carrying capacities), can readily give us the right axle for each of our many models. Delivery is always good . . . prices low!"

"At the present time," Mr. Williamson concludes, "we use mostly Clark *planetary* axles. They afford the same important benefits in our kind of relatively slow operating equipment as they do in truck cranes and similar mobile vehicles: far less strain on power trains, far greater axle life."

These same benefits probably can be applied to *your* vehicles. We'll be glad to show you first-hand. Write for catalog sheets on the type and size axles you need.

Besides axles, some of Bros' broad line of self-propelled compactors also contain Clark TransVerters: a transmission-clutch-torque converter package so smooth starting and shifting "the rollers don't scuff even the freshest-laid asphalt."

CLARK® EQUIPMENT

TransVerter is a trademark of
CLARK EQUIPMENT COMPANY
AUTOMOTIVE DIVISION
BUCHANAN 11, MICHIGAN

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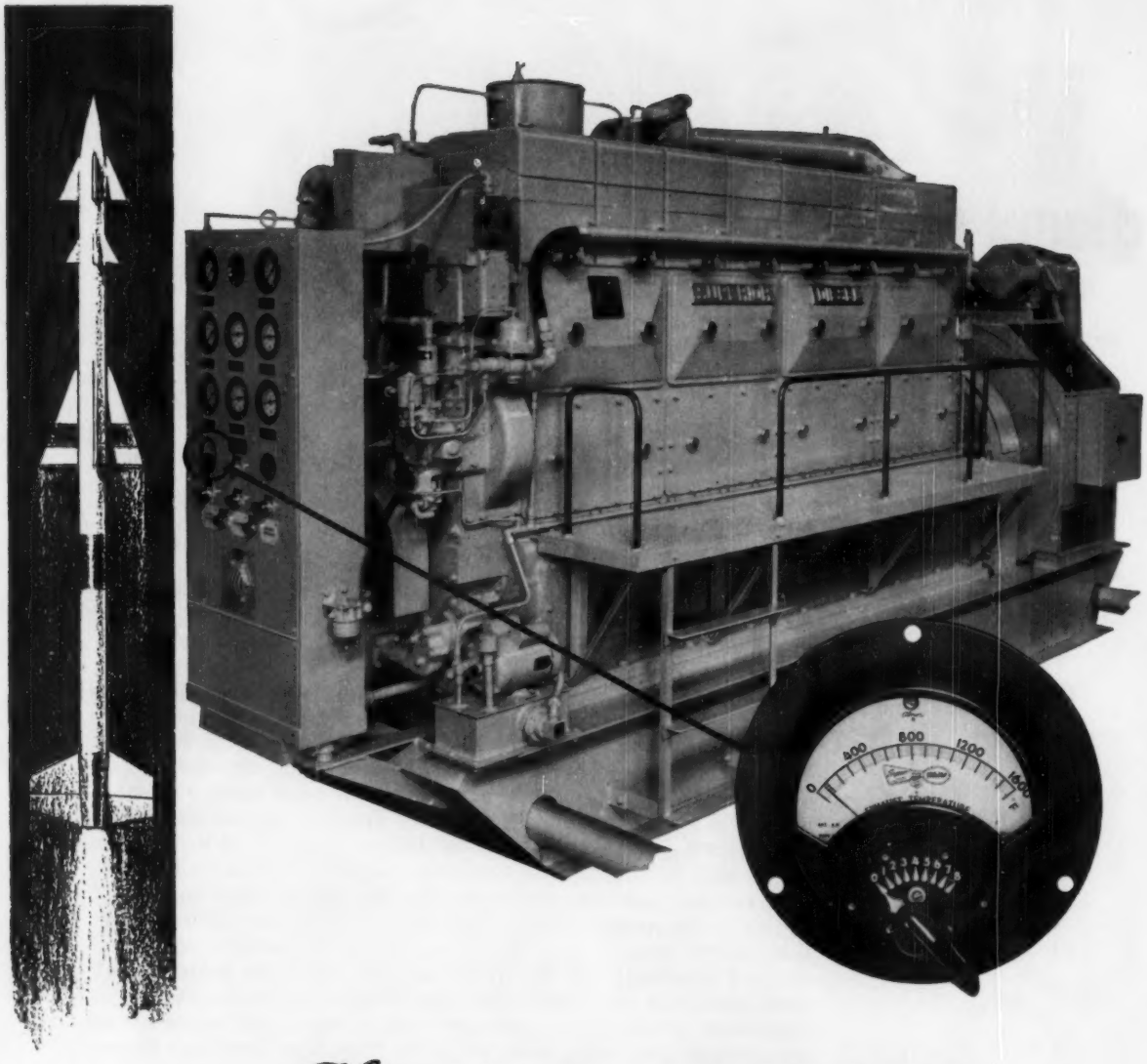
NEUC Emerges

There's a new organization in our industry that's gathering force. It's the National Engine Use Council and you'll be hearing more and more about it as it swings into action. What is it . . . and what action? It's a new trade association, an alliance of firms and organizations having a stake in development of a bigger, better and more cohesive internal combustion engine industry. Actually, we haven't had an industrial engine industry; we've had a number of individual manufacturers, each promoting use of its products as it best saw fit. There has been no single, effective association having general industry support that could speak for the industry as a whole or promote its welfare. From the support that NEUC is already getting, it appears that all the different segments of the industry—engine builders, accessory and component suppliers, fuel and lubricant suppliers—are more than ever aware that this vacuum exists and are betting on the council to fill it. As to action, NEUC has outlined their aims, and the program to achieve them, in a booklet available for the asking. Promotional and educational programs about the industry as a whole stand high on the list of objectives. Factual cost studies and preparation of technical data on what modern engines and engine systems can accomplish are being developed by the Utah State University Engine and Fuel Project with the support of NEUC. This material will be published for broad dissemination. More people will know about the capabilities and economics of modern engine power. To insure that engine users get what they bought, NEUC plans aid in development of service and maintenance programs. This could take many forms, for example, encouragement of guaranteed maintenance programs. Then there's financing. The cost studies developed should help here. They would give local financial institutions a better picture of the soundness of engine use and application. This plus the impact of educational programs, should create a more favorable financing climate. These are some objectives of NEUC. How much they accomplish will depend to a great extent on the degree of support obtained from our industry. With broad support, this cooperative effort of those with the most to gain will create a bigger and better industry. All involved will benefit in proportion. Get behind NEUC!

B.P.E.



Alnor® PYROMETER

On guard 24 hours a day to assure maximum efficiency in operation and smooth power from this White Diesel generating unit in Atlas ICBM rocket launching sites.

A turn of the knob on the Alnor Pyrometer will give an instant check on the operating efficiency of each cylinder by indicating the individual exhaust temperature.

Improper injection, blow by, stuck rings, failure of cooling, overload or other malfunctioning of the engine can be immediately detected and corrected before serious damage is done. This is why most diesel power plants today are Alnor equipped.

ALNOR INSTRUMENT CO.

Division of **Illinois Testing Laboratories, Inc.**

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diesel power

highlights

STUDEBAKER-PACKARD IN DIESEL TRUCK BUSINESS

S-P Corporation will soon be producing the first line of medium-duty trucks and tractors equipped with basic, unconverted diesel engines. . . . Production is scheduled to begin in June. . . . Diesel power plants will be GM Detroit Diesel 4-53 engines, which already have a well established dealer-service organization. . . . Ratings for the diesel trucks are 19,500 and 23,000 GVW, and 35,000 and 41,-000 GCW. Four wheelbases range from 131 to 191-in.

MOST SERIES 53 DIESELS ARE REPLACEMENT ENGINES

According to H. R. McKnight, Manager, Truck Engine Sales for GM Diesel Ltd. (Canada), most of the series 53 engines now in use in trucks are replacement units in vehicles that were in service prior to the engines. . . . Performance data collected has come largely from operators. Results show lower operating costs, naturally, but also increased productivity in large and small-to-medium truck applications.

MARMON-HERRINGTON TO MANUFACTURE GIANT TRUCKS

One of the oldest names in the automotive industry, Marmon-Herrington, has entered the truck manufacturing business (see page 51). . . . M-H was organized originally as Nordyke & Marmon in 1851, became Marmon Motor Car Co. in 1926. The first 500-miler at Indianapolis was won by a Marmon Wasp. . . . Actually, M-H has been in the truck business for years making specialized all-wheel-drive vehicles for military and industrial use. . . . New trucks will be built at the company's Indianapolis plant.

ASME HIGH-LIMIT GROUP ACCIDENT INSURANCE

A new plan for ASME members has upped the accidental death or dismemberment clause from $5000 to $200,000. . . . Plan is optional to members. . . . Society has acted in behalf of members who travel frequently, though coverage is for all accidents, anywhere, anytime.

BRITISH RAILWAYS CARRY AUTOS, TOO

Passing some of the savings of the diesel engine on to the motorist, British Railways have instituted a piggy-back of their own. Motorists can get aboard and take their car along on the same train. . . . Total cost, especially over long hauls, is far cheaper than driving.

NEW USE FOR MANURE

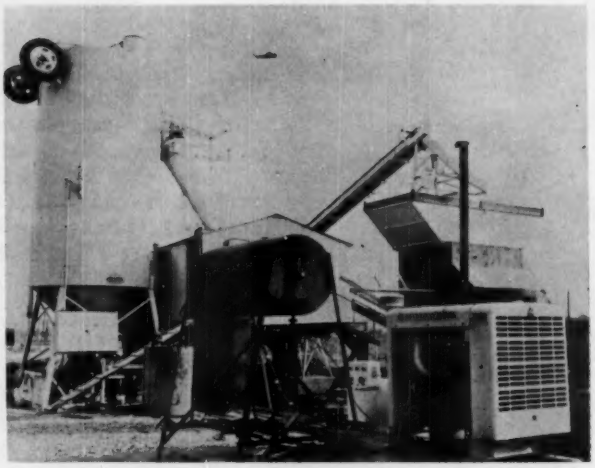
From the Dark Continent comes light on what to do with the manure pile—convert it into power. One South African farmer reports that for more than 18 months he has run a converted slow-speed diesel 24 hours a day on gas produced by his system. . . . Engine turns an alternator that supplies all power requirements for his farm and three houses. . . . In the process, there is no loss in fertilizing value. . . . Surplus gas is used to operate refrigerator, stove, etc. . . . One rub is that heat must be applied to the pile. This farmer uses a second "natural gas" engine with heat exchanger in the pile. Second engine also operates on the gas it helps generate.

ALLIS-CHALMERS EXPORTS HIGH

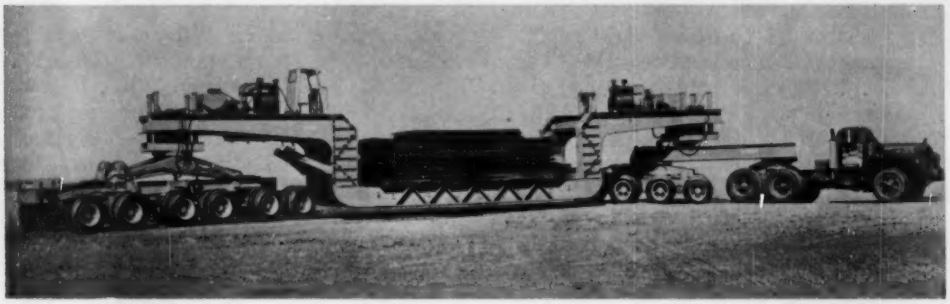
Allis-Chalmers annual report showed that export sales of products produced in U. S. and Canada were 33% higher in 1960 than they were the year before. Company president R. S. Stevenson said, "This approaches the all-time record in spite of the difficulties which we Americans run into—a tendency to price ourselves out of the world markets."

diesel power

news section

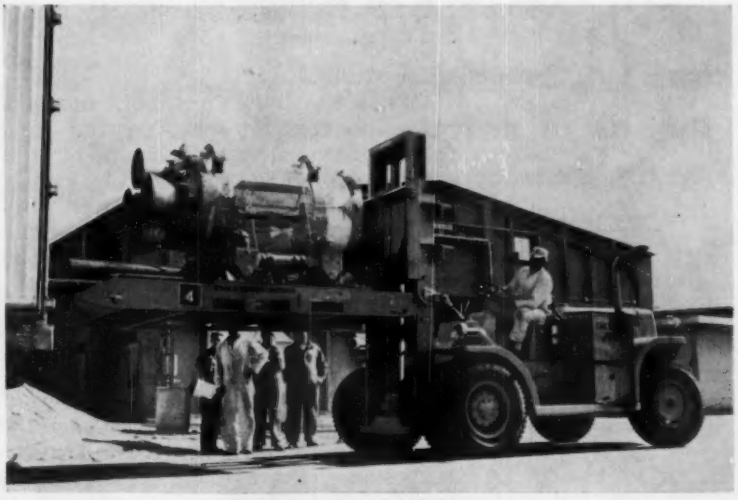


Multi-Purpose Power
Generator powering lights, electric motors, conveyors and hydraulic pumps for Laqua Construction Company's concrete project at Ft. Sill, Oklahoma, is driven by International UDT-817 turbocharged diesel engine. Current produced is 220 to 440-volts, three-phase, 60-cycles. The contractor is working on phase of expansion program north of Lawton, Okla.



A Really-Big Tractor(s)-Trailer . . . This 85-ft 40-wheeled monster is power-steered front and rear with aid of two diesels. One heavy-duty Mack tractor pulls, another pushes on steep grades. Crew includes two tractor drivers and two trailer drivers. Load is spread over ten axles. Mission is to haul hydroelectric generators in Iran.

Truck with Safety Features to Handle ICBM Rockets
Third stage rocket motors for U.S.A.F. Minutemen are loaded by an 18,000-lb capacity fork-lift with special safety features to avert danger of accidentally igniting a rocket's solid fuel. Truck was manufactured by Clark Equipment Co. Diesel engined vehicle has no electrical system, all systems are hydraulic or mechanical; conductive rubber tires.



New Tech Center

Onan Div. of Studebaker-Packard has opened a new technical center in Minneapolis, to expand research and test facilities to speed up study in the fields of fuel cells, transistorized invertors, generators, etc.

Automatic Control Conference

Sponsored by AIChE, AIME, ASME, IRE and ISA, the Second Joint Automatic Control Conference will be held at the University of Colorado, June 28-30. Attendance is expected to be about 1000.

At ITTE Show

Among the exhibits at the San Francisco International Truck, Trailer and Equipment Show (June 28-30), will be Ford's first entry into the diesel market, the HDT model. Also, Cummins will have four cutaway engines for those who like to watch what goes on on the inside.

Cummins-Jacobs Engine Brake Distributor Named

Colorado Kenworth Co., Denver and Omaha Division of Kenworth Motor Truck Co., has been named exclusive distributor for the Jacobs engine brake for several of the Rocky Mountain and High Plains states, handling sales and service.

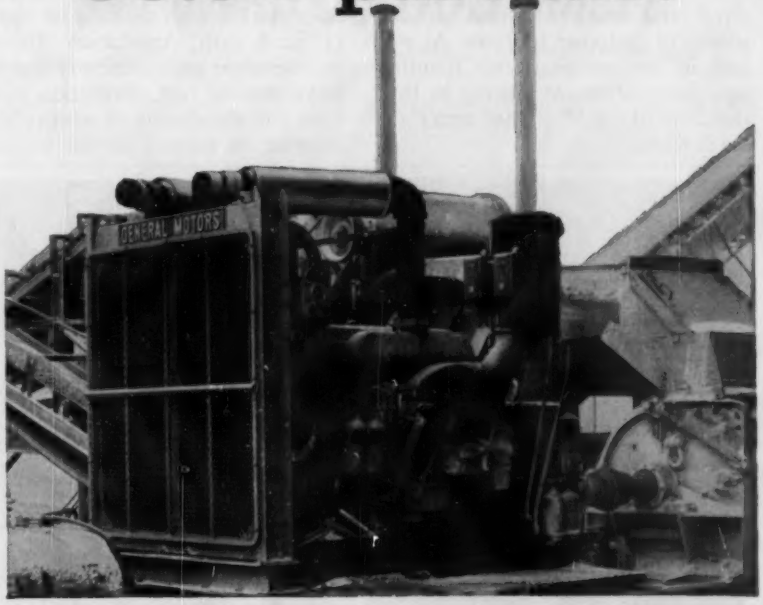
International Truck, Trailer and Equipment Show

The list of manufacturers scheduling exhibits at the ITT&E Show is growing. GM's Detroit Diesel will be showing in-line and "V" models that meet requirements for light and heavy-duty trucks ranging from 25,000 GVW to 85,000 GVW. In addition, "cut-away" engines will be shown. Exposed moving parts will be actuated to simulate operation. Completing Detroit Diesel's exhibit will be a photo display of their truck line.

The International Truck, Trailer and Equipment Show will be held in San Francisco, starting June 28th.

Crusher dust gets so thick you can't breathe . . . but

Donaclones deliver 99.9% pure air!



New factory equipment on many leading makes of engines

Dust gets so thick around this ag limestone plant, it often hides the equipment. Diesel engines on crusher and hammermill used to require frequent overhaul with expensive downtime.

After Donaclones were installed, engines were operated according to the previous overhaul schedule and then examined. *They showed practically no signs of wear.*

The Donaclone's primary centrifugal cleaner removes 98% of the dust. Only 2% remains for the Duralife paper filter giving it an extra-long service life. And it can be renewed when necessary, by dunking in water and detergent.

Add years of engine life by modernizing with Donaclones.

Write for name of dealer

Side inlet model

Center tube model

Donaclone by Donaldson

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Mack Modernization

A streamlining move by Mack Truck grants field management personnel more freedom of action on the local level, permitting more rapid and decisive action in all phases of customer relations. As we said in our editorial, two months ago, distributors are moving in the direction of OEM, if they aren't already there.

LMOA Pre-Conventions

The Locomotive Maintenance Officers' Association is going all over the country to gather information for final reports that will be discussed at the Chicago meeting on Sept. 11, 12 & 13th. Association officers and members are sparing no effort to make this the best convention ever, from the standpoint of worthwhile information secured for the benefit of the RR industry and the men who maintain its diesel locomotives.

A series of pre-convention presentations are underway, in various locations, to attract the highest participation at the local level from groups of local RR officers. Off-line travel is unnecessary. This approach works well to bring out people who might not be able to attend a national meeting.

For information relative to the meeting nearest to you, contact the Association.

AERA Convention

The 39th Annual Convention of the Automotive Engine Rebuilders Association will be held May 14-17th at Hotel Fontaine Bleau, Miami Beach, Florida. Scheduled lectures and discussions will be of interest to businessmen in this or related fields.

Model C Tournapull Now Has 290-hp GM V-71

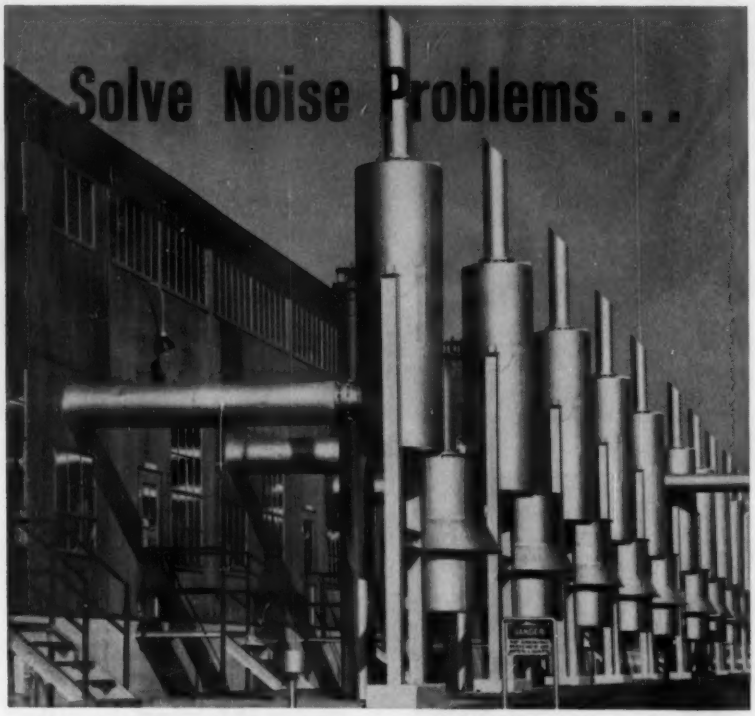
Power of LeTourneau-Westinghouse's Model C has been upped to 290-hp by changing the injectors of the GM V-71 from 55mm to 60mm. Clutch lining has been changed to handle the additional torque.

New GM Diesel

GM Bedford diesel is being distributed in Canada by GM Diesel, Ltd. Models available are the Bedford 200 (cu in) and the 300 (cu in). Units are in-line 4 and 6-cyl, fitted with C.A.V. injection. At present, 50,000 Bedford trucks and commercial vehicles are operating all over the world. Engines are being made in England by Vauxhall Motors, Ltd (GM).

Stimulant for Western Industry

Governors of 13 western states, with the cooperation of top industrialists and the U. S. Dept. of Defense, are launching a huge project to stimulate industrial production. Increased activity is important to engine producers and component suppliers alike. First step is an Industries and Engineering Exposition, to be held in San Francisco.



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He is a specialist in designing silencers to meet noise problems of all types of engines from giant diesels to "go-karts," as well as special purpose silencers for jet aircraft, atomic submarines, waste disposal plants, chemical plants and heat recovery applications.

Let us know your problems . . . we will work with your engineers . . . on your team . . . to solve them.

Immediate delivery on most standard type silencers from regional stocking points. Write or call today.

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For more information write in No. 209

NEWS SECTION . . .

Self-Adjusting Brakes for LeT-W Graders Now

All LeTourneau - Westinghouse-Adams graders shipped from Indianapolis after May 1, will be equipped with Bendix Duo-Servo self-adjusting brakes as standard equipment.

F-M Bids Low for Glen Canyon Generators

A $7,467,605 proposal by Fairbanks, Morse to supply generators to the Glen Canyon Power Plant, is the apparent low bid. Contract is expected to be awarded in the near future.

Diesel-Electric Oil Well Drilling Rig

Canada's first diesel-electric oil well drilling rig, in use by Cascade Drilling Co. in the Swan Hills field, has completed its second hole. Company president Matheny said the "tear down" period required from rig-release on the first hole to "spud-in" on the second ". . . was accomplished in just over 25 hours. Limited light conditions coupled with adverse weather made this move even more impressive".

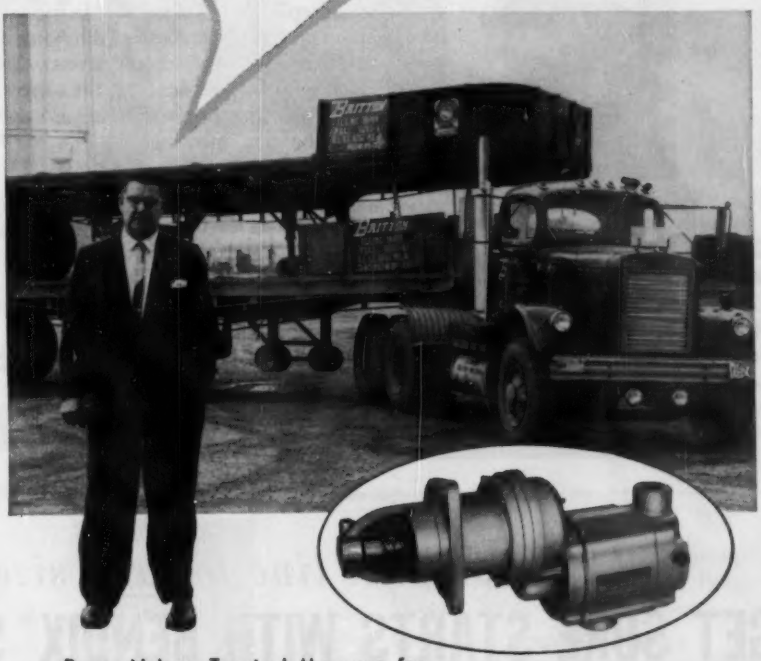
Cheap Power for Brazil

The Brazilian city of Fortaleza had a need for electrical power, also a nearby and plentiful source of low-grade extremely-viscous crude oil, the consistency of petroleum jelly. Fairbanks, Morse found that their 38D8 ⅛ engines could burn this fuel without excessive maintenance. Contract award included special pre-heaters, filters and centrifuging equipment. Result is cheapest power the 30,000-population city ever had.

Ready for '63

It may seem a bit early, but the Construction Equipment Exhibition and Road Show, scheduled for Feb. '63, is being planned. Boyd S. Oberlink, vice-president of Allis-Chalmers, has been named Chairman of the Administrative Committee.

"AIR STARTER requires no repairs in 5 years and over 700,000 miles!"



Roger Nelson, Terminal Manager for Britton Motor Service at their Chicago base has this to say about Ingersoll-Rand Air Starters . . .

"Your Size 9BM Air Starter was applied to one of our Cummins diesel powered White trucks. This truck was in operation for five years and accumulated in excess of 700,000 miles. We are very satisfied with the service life and operation of your Air Starters. The newer Size 10BM we now have in service has even more power."

You can cut fleet maintenance costs with modern Ingersoll-Rand Air Starters by eliminating the costly replacement of batteries. These units produce surer, faster starts and are unaffected by extreme weather conditions.

Ingersoll-Rand Air Starters are made in 4 sizes for starting diesel or carbureted engines from 300 cu. in. to 20,000 cu. in. displacement. For complete information on these efficient starters . . . write for your copy of "Go Modern—Start with Air", Form 5094E.

Ingersoll-Rand

11 Broadway, New York 4, N. Y.

210A-18

For more information write in No. 210

diesel power

news—people & plants

Admiral Smellow (Ret.)

General Manager for Lengor

Rear Admiral **Morris Smellow**, Supply Corp., U. S. Navy (retired) has been named general manager of **Lengor**. He will also head Lengor's companion firm, **Gordon Laboratories**.

R-M Elects V-P

Joseph N. Kuzmick, divisional manager of **Raybestos-Manhattan** and director of the corporation, was elected vice-president at the director's meeting following the annual stockholders' meeting.

Top management changes at GM

GM's Central Foundry Div. announced that **Thomas R. Wiltse** has been appointed divisional director of reliability; **Thomas E. Smith** has been appointed plant manager of the Defiance, Ohio plant; and **Dale W. Wonus** is now plant manager of the Danville, Ill. plant.

K. L. Hulsing

Detroit Diesel's Asst Engineering Director

Kenneth L. Hulsing has been named assistant Director of Engineering for **GM Detroit Diesel Engine Div.** Prior to this appointment, he was staff engineer in charge of product design. This post has now been filled by **C. E. Ervin.**

C. E. Ervin

The complete line for any size diesel . . .

GET SURE STARTS WITH BENDIX® STARTER DRIVES

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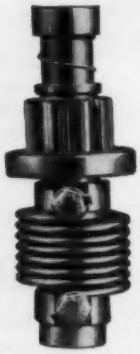
FRICTION CLUTCH DRIVE



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*TRADEMARK

Bendix-Elmira

Eclipse Machine Division

Elmira, New York

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come CLEAN
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For carbon-encrusted pistons or ANY diesel cleaning problem, there is a Lix Cleaner that will DO IT BETTER and SAVE YOU MONEY. Lix Cleaners soak away every bit of grime, grease and burned-on carbon quickly and thoroughly, with absolute safety to workmen. All metals can be cleaned in the same tank at the same time, meaning more parts cleaned per dollar invested!
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With the Kiene portable hand-grip hydraulic test pump and universal test stand you can make all conventional nozzle tests — plunger and bushing tests on all General Motors unit injectors — plus having many new and exclusive test features not found in existing tools. This compact, rugged and revolutionary design gives field servicing new accuracy and scope — speeds repair of diesel rigs with less down-time delay. All sizes connector nuts available.
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KIENE DIESEL ACCESSORIES, INC.
10352 PACIFIC AVE., FRANKLIN PARK, ILLINOIS

For more information write in No. 213

Joins Gould Pumps

A. J. "Woddy" Hermann has joined Gould Pumps as engineering product manager.

A-C Names Two

Allis-Chalmers Industries has appointed Gerhart O. Richter as field superintendent, and John R. Wren as mid-Atlantic regional field service engineer.

M. S. Stolarz

V-P AMF International

Matthew S. Stolarz has been appointed vice-president, General Products, AMF International, a division of American Machine & Foundry. Mr. Stolarz will direct export activities.

R. L. Boyer

Cooper-Bessemer Names V-P Advanced Planning

R. L. Boyer has been elevated to Vice-President of Advanced Planning for Cooper-Bessemer. His function will be to study products that can contribute, by acquisition, to C-B's diversification. D. L. Gallogly, C-B's chief engineer, succeeds Mr. Boyer as operating head of the engineering department.

American Bosch Names

James J. Clarke has been appointed manager, central region, commercial Sales Div. of American Bosch Arma Corp. Region headquarters are in Cleveland.

Borg-Warner Names

C. Gregg Geiger has been appointed sales manager for Borg-Warner Service Parts Company.

Cleveland Graphite Names

Frederick P. Salzman has been named executive assistant to the general manager, W. D. Cameron, of Cleveland Graphite.

Bendix Filter Names

Arnold L. Crouch has been appointed sales engineer, midwest territory, Bendix Filter Div., Bendix Corp. Offices are located in Dayton, Ohio.

For Distinguished Service

Five engineering-industry leaders were recommended for distinguished service citations by University of Wisconsin College of Engineering faculty and president, and the recommendations were approved by the Board of Regents. Citations will be awarded to John C. Chyle (A. O. Smith Corp.); William T. Ennor (Alcoa); Oswald J. Muegge, (Wis. State Sanitary Engineer); Merrill A. Scheil, (A. O. Smith); and Frederick M. Young (founder of Young Radiator).

WHY do engines fail?

One company decided to find out. Halliburton, with over 1000 diesel engines in the field that operate at one of two speeds—idle or full-load—set up a plan to find out the specific causes in order to prevent their occurrence.

by Dwain Christian
Superintendent, Fleet Maintenance
Halliburton Company
Duncan, Oklahoma

Halliburton Company is primarily an oil well servicing company. The principal source of our revenue is derived from oil well servicing; The principal service being to pump a variety of fluids into an oil well. Thoughout the free world, wherever oil or gas production and drilling is carried on, Halliburton is close by. Throughout our domestic operations, we have equipment and offices operating in approximately 190 locations, or districts. Manning of these locations varies from two men to over 200, varying to suit the needs of the particular areas.

Our major source of revenue, our pumping services, is also our major operating cost. Cement, acids, oil and sand mixtures, water and sand mixtures, walnut hulls, salt water, hay—you name it and we've probably pumped it into an oil well. Our pumps are powered by diesel engines, ranging from 90 to over 600-hp. Pumping power requirements vary from 100 to over 8,000-hp. Pumping time may vary from just a few minutes to 60 days. Pressures vary from practically none to over 20,000-psi.

Consequently, our equipment must be very flexible and highly mobile. We have our maintenance problems with every item. Some are unique with our operations: others are universal with the heavy equipment industry.

Since the diesel engine is the heart of the pumping operation, this discussion will be limited to this one item. We have in our fleet approximately 850 diesels of over 300-hp, and approximately 200 over 600-hp.

To Halliburton, like any company that depends on transportation or mechanical power for its livelihood, the problems involved in efficient fleet operation are altogether different today from even ten to fifteen years ago. Then, the pride of our fleet had two 100-hp diesel engines, or a total of 200 hp. This unit was as big and

Dwain Christian presented this material as a talk before the Association of Diesel Specialists in San Antonio, February 25, 1961.

as heavy as the law would allow to travel down our highways. Today, we have units with two diesel engines that develop over 600-hp each, with approximately the same legal restrictions. Purpose of the two units is the same—to pump fluids down an oil well—but at this point, the similarity ends.

During the past 15 years, machines have developed from relatively simple mechanisms to extremely complex equipment, while basically, the job is the same today as it was ten to twenty years ago.

There was not enough heat developed in combustion chambers of the old units to provide a desired cooling water temperature on a cold day. In contrast, today's unit develops heat in the combustion chambers equivalent to a 90, 100,000 BTU/hr furnace. This would heat ninety six-room houses in zero weather. Maintenance problems with these engines that develop from 50 to 65-hp per cylinder are much more severe than that of engines that developed from 20-30-hp per cylinder of about the same size.

When a piston or bearing seized on a low output engine, the engine stopped. Generally, all that was required was the replacement of the shaft and bearings or the piston and liner. When a piston or bearing attempts to seize on today's high output engine, the remaining cylinders keep on driving the engine to total destruction. There is practically no salvage value whatever in an engine where a rod has knocked out both sides of the block, broken up the pan and wiped out most accessories mounted to the engine. The few parts that are salvageable become surplus after two or three of these failures.

Unfortunately, the initial cost and the various and sundry costs involved in the operation of this equipment have increased almost proportionately with the increased output.

Cutting Costs

Let's assume top management releases an order that says—"Expense shall be cut by 10% next year." Fifteen years ago there would have been three obvious alternatives: (1) Hold off on buying new vehicles; (2) Cut down on the number of man hours and parts spent on each vehicle; or (3) Buy a lower quality of replacement parts, tires or fuel.

Today, none of these three measures will answer the problem. Next month's or next year's balance sheet might look better, but with today's complicated and expensive equipment, operating costs will eventually rise. Somewhere down the line, these seemingly simple measures will impose much greater problems upon the operating costs of the fleet. Where, then, is the answer to high maintenance and operating costs?

Finding the Causes

Approximately three years ago every diesel engine and every heavy-duty gasoline engine over 400-cu in. displacement that was returned to our main shop in Duncan was inspected by members of our fleet maintenance department, our engineering department, our shop personnel, and in many instances by members of either the engineering or service section of the original manufacturer or manufacturer of the component parts.

In nearly all cases where the engine was destroyed, normal wear was not the primary factor contributing to its failure. Some of these failures were due to faulty material, design or workmanship. Some were due to abuse of some form or another to the engine. Problems involving material, design or workmanship were referred to the manufacturer. Determining the cause of abuse was complex.

Abuse, as used in this discussion, is any action or lack of action, intentional or unintentional, by any person either operator, mechanic, supervisor, management, or even original manufacturer, that would tend to place any operating part of the engine in distress, leading to a premature failure.

We also set up our field maintenance reports and Road Call reports on IBM. We were able to analyze the failures by groups, such as cooling system failures, lubrication failures, electrical failures; or by vehicle type, vehicle make and model; location and so forth. We found that a large percent of engines that suffered destructive failure had at some time, within a five-month period, reported a failure of cooling system or lubrication system. There was also a high percentage of engine failures within 90 days after their installation or overhaul. This included new engines, engines rebuilt in our Duncan shops, engines rebuilt on contract, or engines overhauled in the field shops.

Causes of Failure

During this time that was spent locating the sources or causes of premature failures, it became very evident that nearly all failures were of a progressive nature. In many cases, bearing failures accompanied excessive piston ring wear. We also found that in addition to the failed bearing, other bearings were in various stages of failure. In many cases, the material that was found imbedded in other bearings was completely foreign to the engine itself. This added up to only one conclusion—the dirt was poured into the engine, or it was built into the engine, or it was brought into the engine through the air intake system or engine breathing systems.

From data catalogued over six-months operation, several patterns began to form. The contributing cause of the failures fell into the following categories: (1) Oil contamination by dirt, fuel oil dilution and water (2) Loss of lubrication to the bearings (3) Cooling system failures (4) Fan and water pump belts (5) Air induction system (6) Improper assembly of liners and sealing rings (7) Piston and piston ring design, material, and/or workmanship (8) Piston rings not properly seated before maximum output was taken from the engine.

In many instances the abuse was a combination of two or more of the above items.

Each of the problems was tackled individually. It became immediately apparent that as the source of one abuse was located, another abuse was found. Instead of working on the cause and effect basis, we studied the effect and then investigated the probable cause or causes. This investigation was carried on primarily in the field at the operating locations. As an effect was found, the unit was shut down until the cause was determined.

Lube Oil Contamination

The problem of lube oil contamination was first investigated. A simple oil test kit was used to test oil from operating engines to determine these effects: (a) fuel oil dilution; (b) water contamination; (c) acidity; (d) detergent or dispersant level; and (e) soot load. With effects known, causes could be determined.

Fuel Oil Dilution—Cause 1 was leakage at the fuel inlet tube. It was found that a large percentage of injectors had a poor seating surface. The manufacturer corrected this on subsequent production and we corrected those in service by reworking the seats in the injector bodies.

Cause 2 was leakage at the injector cup gasket. In some cases the injector body needed reseating and in others our personnel had been careless in assembly of the cup to the injector body.

Cause 3 is leakage between plunger and body. This has not been too great a problem.

With continued use of the oil test kit and appropriate corrective action, excessive fuel dilution is no longer one of our major problems.

Water Contamination—Cause 1 is injector tube leakage, both at the upper and lower seat.

Cause 2 is head gasket leakage, always a problem on all makes and types of engines.

Cause 3 is liner ring seals.

Cause 4 is oil cooler leakage. This could generally be attributed to corrosion at the point of contact between the tube bundle, the housing and the end-plates. This is particularly evident where dissimilar metals are used. Distortion problems are also encountered.

Water contamination is generally recognized by the oil test kit. In many cases the specific cause is located by use of the cooling system pressure tester.

Acidity, Detergent/Dispersant Level, Soot Load—While these have been determined by use of the test kit, generally speaking, they have not been too much of a problem in our operation.

Loss of Lubrication to Bearings

Breakdown of the causes for such failures showed that they fell in three general categories: (a) System component failures; (b) damage to some part of the system; and (c) servicing deficiencies.

System Component Failures—Most failures were in the external hose lines. Cause 1 is a tendency to assume that these are good forever and, therefore, slight them on inspection. They must be watched for signs of deterioration and periodically inspected, particularly in hard-to-get-at places, for signs of rubbing and wear.

Cause 2 is a corrosion problem, usually confined to operation in certain areas. In parts of the Gulf Coast area, the atmosphere has resulted in complete disintegration of some aluminum fittings. Wire braids on hoses have corroded and, lacking strength, hoses have burst. In such areas, solution lies in use of less-susceptible materials when possible and, frequent inspection.

System Damage—Primarily, damage occurs to the external lines. During servicing and repair operations, often on some other engine component, damage may be done to the lines on fittings. This may go unnoticed or if noticed, not corrected.

Damage may also occur through accidents. For example, we have had holes knocked in the bottom of oil pans.

Servicing Deficiencies—Such seemingly minor lapses as not tightening a drain plug adequately or improper installation of a lube oil filter can ruin an expensive engine. However, even if the mechanic goofed, the operator could save the engine if he watched the gauges. The solution is twofold: Emphasize greater care in maintenance and impress operators with their responsibility.

Cooling System

Cooling system pressure testers were originally used to aid in finding internal leaks. But we have found more external than internal leaks. When 15-psi was applied, leaks sometimes seemed to sprout from everywhere. We found that original-equipment radiator hoses and heater hoses had a tendency to deteriorate very quickly.

Radiator leaks at header plates after a few months of service were numerous. We also found that hoses were worn in two by abrasive action from crossmembers, oil lines, air lines, even the cab and sheet metal. Many hours were spent re-routing these lines, and in some cases, crossmember and structural supports were changed to give clearance for the radiator inlet and outlet hoses.

Fan and Water Pump Belts

While we were looking at our hose problems, we found that even simple belt drives of the fan and water pumps were often the culprit in starting an engine failure. In many of our high-output engine applications, fan loads run between 30 and 40-hp. In many cases fan drives were border-line installations, even under the best conditions. Add to this the high operating temperatures, oil soaking, and very poor means for belt tightening adjustments and it's a miracle that some belts will carry the load for even a period of ninety days.

Many belts are ruined on their installation. The old practice of forcing a belt over a sheave is an abuse that might lead to an expensive engine failure 90 to 120 days later. And proper belt tension is very critical, especially with wire-cord belts.

Air Induction Systems

Air induction systems soon came under close scrutiny. These, like the cooling system and belt systems, were at first taken very much for granted. They were given only servicing at regular intervals as recommended by the manufacturer. Then, in many instances, we found that the cab and tin work, oil lines and air lines would wear holes in the induction piping. Also, in many cases, exhaust manifold heat would burn holes in the rubber connections. In all cases, these holes would be on the blind side.

In our operation about 75% of operating time is at idle; the other 25% being full-load, full-speed. Oil-bath air cleaners that would let through sufficient air at full-load, full-speed, would not clean the air at idle. If we used a cleaner sized for effective cleaning at idle, intake restriction would be excessive under full-load.

We then changed over to dry-type air filters. We found they cleaned the air very effectively. After they became plugged they might not let through any air, but

Twin HT-400 Fracturing unit. Each pump is powered by a VT Cummins 600-hp diesel. Engines either idle or take full load.

if they did, it was clean. Under severe conditions, we would install a new element and within 50 miles of off-highway driving, the element would become plugged to the extent that we would have to replace the element to obtain enough power to do the job.

We then followed the old approach, "If one is good, two should be many times better." Intake restrictions of 10-in., water, with a single new element was reduced to 2-in., water, with dual elements. Filter element life was increased many times. We have set a maximum 10-in. restriction for turbocharged applications.

From this change in air filter capacity, came a very beneficial side effect. Turbocharger life was greatly increased. Exhaust temperatures dropped from approximately 1100°F at 20-in. to about 950°F at 5-in. restriction. Turbo speeds were also reduced at the lower restriction.

Piston and Piston Ring Failures

Problems involved with piston, liner, and ring failures are much more complex. A few of the fundamental causes for a piston and liner failure, are cracked piston; cracked liners; cylinder block distortion; injector tube leakage allowing water to enter the combustion chamber; rings not perfectly seated on their original or replacement installation; overheating of the engine; wavy or imperfect ring grooves of the piston at time of manufacture; excessively worn ring and groove; the manner in which we store our engines; and many other items which would lead to a poor seat or destroy a good seat between the ring and the liner, or between the ring and piston.

First step was to develop a simple procedure whereby the condition of the ring seat could be determined or checked periodically without engine disassembly. Since piston rings and the oil film between piston and liner are the sealing media for holding the high-pressure, high-temperature gases in the combustion chamber, measurement of blow-by is a very accurate indicator of the ring's sealing effectiveness.

We have had excellent results in determining the quality of a ring seat by measurement of blow-by—by measuring, through an orifice, crankcase pressure developed. We reduced the number of destructive failures from approximately four per month to slightly over one per month. Considering that we have 1000 engines over 300-hp, we feel that we are on the right track.

There is certainly more involved in getting true readings than merely hooking up a water manometer and reading the indicated crankcase pressure to see if the rings have seated. Some items that we have found that tend to give false reading are:

(1) A loose injector to injector-tube seat fit. This can generally be spotted by carbon build-up around the injector and valve springs.

(2) Worn valve guides. Sometimes worn valve guides on supercharged engines will give a high reading. A naturally-aspirated engine may tend to read low.

(3) Blow-by past rings in an air compressor will give a high reading.

(4) Leakage of air past oil seals in the turbo or supercharger will contribute to high readings.

(5) Gas leakage through the accessory drive seals will give a low reading on the water manometer.

We are equally suspicious of both abnormally-low reading and abnormally-high reading. Our final check to determine if rings are properly seated is to place the engine under full-load, full-speed for 30-minutes continuous operation. If there is no rise in crankcase pressure, we are then confident that rings, pistons and liners are in good operating condition.

We specify this test to (1) the engine manufacturer and (2) our Duncan manufacturing facility. It is also performed before delivering a new unit to our field operation; upon receipt of the unit; at regular inspection intervals; and immediately after any abnormal operation.

Ring seating is a very controversial subject. It seems that what might be the answer with one engine of a particular make and model may not be the answer for another engine of that same make and model. If the answer is the same, we haven't found it. And we have had the help of a lot of experts. However, we have found that if the ring forms or makes a perfect seat between the groove side-walls and the face of the ring to the liner, then satisfactory service can be expected.

More Cooperation Needed

While all of this maintenance research and testing was going on, we became painfully aware that technological advances in equipment during the past few years have gotten way ahead of the users—and even the manufacturer who built the component.

For best utilization of technological advances, there must be parallel advances in the supporting field organization of both manufacturer and user. Many problems with today's equipment do not yield to the same solutions that have served in the past.

Time and competition, as it is today, will not permit either manufacturer or user sufficient time to work out all the bugs in both equipment and personnel before a product goes into mass operation. Then if something goes wrong, it's too often an occasion for finger-pointing and name-calling when it should be a matter for deep concern and full cooperation.

If we can get both user and manufacturer to face the fact that they can learn from each other and need each other's help, perhaps then we can overcome some of the "human lag" and begin to realize the full potential of today's technology embodied in modern equipment.

Today's Diesel Man . . .

"I don't know whether you'd call me a 'diesel man' or an administrator. It's for sure that this job calls for both talents." This was Bill Woody speaking. Bill is Southwestern Region Shops Superintendent, Ryder Truck Lines, Inc. We'd call him a Diesel Man without question because today's Diesel Man discharges his vital maintenance responsibility by tight administrative control.

Bill Woody controls activities in four shops, making his headquarters in New Orleans, La., the largest of the four. In all, he has maintenance responsibility for 292 vehicles and 376 trailers and detachable bodies. Of the vehicles, 130 are line-haul tractors, 49 are city tractors, 88 are pickup and delivery trucks (2-tonners) and nine are pickups and yard mules.

Of Bill Woody's fleet, the 130 line-haul tractors and 33 of the city pickup and delivery trucks are diesel powered. In the line-haul group there are 95 Macks, 21 Whites with Cummins engines, 13 GMC's with Series 71 engines and one German MAN tractor. The P & D trucks are International Harvester B-160's with the I-H 301 diesel engines.

Ryder is big and maintenance is a big problem—and one of the largest expense items. Management depends on the whole maintenance team to hold these costs down as low as possible and keep equipment rolling. Spread out the way we are, I have to depend on men like Bill Woody and all the other good men in the same capacity to look out for each area. Through their know how and ingenuity, we keep the fleet rolling at minimum maintenance expense.

D. D. Hodges, Vice President
Director of Maintenance
Ryder Truck Lines, Inc.

In general, the line-haul trucks operate in East Texas, Louisiana and parts of Mississippi. Pegging it down to cities, it works out to Houston, Shreveport, Birmingham, New Orleans and intermediate points.

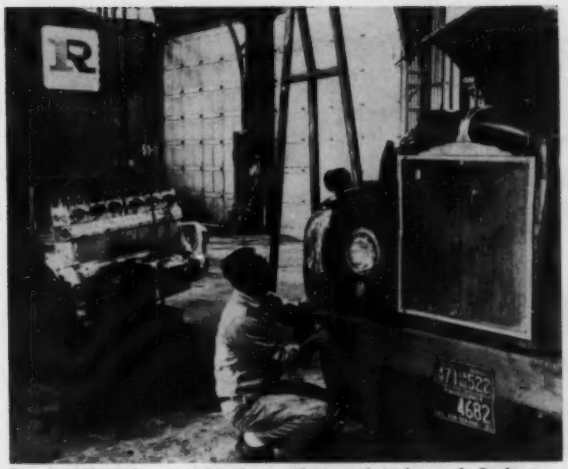
Originally, this area was covered by Texas Storage Co. (TSC) until it was bought in 1957 by Ryder. TSC was operated as a separate company until 1960, when it was merged with Great Southern, also acquired by Ryder, and the TSC operation became Ryder's Southwestern Region. Bill had been with TSC in Houston, and he was brought by Ryder to take over supervision of the shops, in Baton Rouge, Houston, a small one in Shreveport and the biggest in New Orleans. General maintenance supervision for the whole Ryder system is centered in Jacksonville, Florida and is headed by D. D. Hodges, Director of Maintenance and a Ryder vice president.

Operation Teamwork

We were interested in exploring Bill's operation as one within a larger framework. Was it different from, say, running an independent organization of the same size? Did it require different orientation or skills?

"Answering the questions in reverse, I don't think you need different background or different skills However, my background is probably different from that of most men in a similar job. In college I concentrated on business administration. Maintenance is big business today and the training has sure helped.

"Some time back, I worked for Mack as parts manager. Later, with TSC, I was still in the parts end with emphasis on inventory control and purchasing. This is also part of the overall job here and this background has been a help. Parts and shops go together, so by keeping my eyes open, I learned a lot about maintenance procedures and how to run a shop.



Some work is done in the shop, other work is farmed. Body man refinishes fender as rebuilt Mack swings on mobile lift gear.

"I keep learning through experience, from others in the same line and from reading. For example, I read Diesel Power every month and also the trucking magazines. I get a lot of good ideas—better ways to do things, new products—from the trade press.

"As to this being different from an independent company, I don't think so. I have about the same freedom of action. You always have to account to one or another management, and there are always budgets limiting what you'd like to do. Basically, I'd say that opportunity for individual initiative is about the same.

"Obviously it's good to standardize and we do to a high degree. But we can't afford to miss any bets. We're always evaluating new products here or in one of the other regions. For example, now we're testing full-flow lube oil filters, used in conjunction with the by-pass type, to see the effect on engine wear and oil life. Part of the job is finding a better way to do everything.

"Some things I've started show promise. One that comes to mind off-hand is modifying the breathing system on the truck air compressors. We're using a flexible line from the engine's filtered air piping to the compressor.

"Over there (pointing), the welder is making up a water separator. We've been running into trouble with water in our fuel, possibly from a small leak into our underground tanks. We're low and the water table is high. The separator body is a 12-in. pipe, 4-ft long and closed at both ends. It will have a series of baffles in it. Mounted vertically, there's a blow-down valve at the bottom. Fuel will enter near the bottom and flow past the baffles to an outlet near the top. We're also putting a sight-glass on the side to show any water-fuel interface. The records will show how well it works."

Records are the Key

"One worry I didn't have was working out a system of preventive maintenance—or suitable records and forms. These are standard throughout the system. For obvious reasons. All data, even fuel and lube oil records, feed back to Jacksonville for tabulation and analysis."

"We're only one region of Ryder. We have to keep good records on each piece of equipment so that we can do our preventive maintenance on time, and we have to have them for maintenance headquarters in Jacksonville, Florida. Maintenance procedures as well as cost accounting must be uniform throughout the system or we'd be in some mess," stated Bill Woody. "Yet, even though the forms are the same and general procedures are spelled out, the operation in each region is a little different—local conditions, types of equipment used, and even the type of country."

At Ryder, procedures conform to best accepted practices. Driver vehicle condition reports and road failure reports form the basis for non-scheduled repairs. Scheduled PM is set up on an "A" inspection every 30 days which brings complete lubrication to units every 2500 miles plus a more complete "B" schedule at 50,000. Specially-designed stickers list key "Due" dates. A truck can be anywhere in the Region, but when it pulls in for routine servicing, whatever is shown to be due is performed at that shop and a new due-date inserted. Bill Woody stated that terminal managers cooperated very well in seeing that trucks were so routed that they would be available at one of the shops for scheduled PM.

Lube oil, as well as lube and fuel filters, are changed at 5000 miles with by-pass filtration and at 7500 miles with full-flow filters. Usage is such that this occurs about every 15 days, which is a rule-of-thumb to get trucks into one of the shops for servicing.

All of these trucks' cooling systems are equipped with Perry water filters and conditioners. Bill Woody expressed the opinion that they had been very helpful in prevention of cooling system troubles. These are serviced with new elements at 22,500-mile intervals.

New Orleans Has Lead Shop

Heavy maintenance and the major parts stock for the Region are concentrated in the New Orleans shop. Unit replacement is the general principle of operation. Rebuilding of units—engines, transmissions, etc.—is done here for distribution to the other shops. Two rea-

PM includes an "A" inspection at 5000, a "B" inspection at 50,000-mi. Special "due" stickers list key work-due dates.

Two-ton I-H B160-301 diesels have been in service only a few months, already show pronounced fuel economies. Bill Woody has a total of 88 pickup and delivery trucks, of a total of 292.

Some bodies are detachable, as identified by vertical struts. This allows maximum utilization of equipment. Here, an empty sits in yard.

sons given were (1) steady work flow on each type of equipment justifies a high degree of specialization and (2) centralized parts procurement improves purchasing power.

A separate room is used for engine and component rebuilding. Bill pointed out that with their volume of work they could not justify going into crank grinding, align-boring or other heavy rebuilding operations. It's more economic to farm out these jobs when they're required. Then it becomes a matter of bench rebuilding.

Bill pointed out that there is no point in doing your own work unless there is some advantage—cost, time or quality. He emphasized that cost and quality must be considered together; shortcuts don't pay. An example cited was the case of fuel injection equipment. Gerhardt's Inc. is doing their work in New Orleans; Magneto & Diesel Injector Service in Houston. Both are ADS members. Bill said that he could get the work done cheaper but that he'd found that these "cheap" jobs were more costly in the long run.

Outside the New Orleans shop is an open but roofed area where all routine servicing takes place—general cleaning, tire work, greasing, lube changes and the like. Trucks are put on a 2-column lift for inspection and lubrication. A row of dispensing hose reels are mounted on the shop wall adjacent to the lift.

Inside the shop, heavier repair work is always under way. Bill Woody called attention to a rebuilt Mack engine, ready for swap with the engine in one of the trucks. This engine had been reworked by a local rebuilder. Some work is farmed deliberately. First, this is a cross check against Ryder's own work, both mechanically and financially, and, second, it's wise to have an alternate source for work of known quality. This permits a steady work force and work load in the shop with any unusual peaks handled by reliable outside procurement.

Bill stated, "We keep an adequate stock of rebuilt units for all the shops in the Region. Say that one of the shops has changed out a Mack transmission or one of the Fullers on the Whites. They get an exchange unit, and the one removed comes back here for rebuild.

In general, Bill Woody specifies and authorizes the buying of parts, components, accessories, supplies and services within his Region. Other major components, such as trucks, trailers and tires, are specified by Jacksonville.

Results Are What Count

Bill Woody explained that long-term results, particularly as to costs, are consolidated in Jacksonville. He could, however, supply some general data.

Service life on the Macks and GMC's before major engine work averages 250,000 miles and better. No meaningful data has been accumulated on the Cummins-powered Whites, as these are fairly new trucks with only about 50,000 miles on them. So far, they're reported to be doing fine.

The 2-ton International Harvester diesel pick-up and delivery trucks are still on probation. They've only been in service for six to eight months. This B160-301 diesel combination is relatively new, plus the fact that it was new to both drivers and maintenance personnel. While the "bugs" are being worked out, and during the indoctrination period, no immediate conclusion can be drawn, other than that they were definitely fuel-savers. These models were turning in average mileages for city operation of 8.49-mpg, with lift-gate models running somewhat less than the average. When somewhat longer runs were involved, spot averages ran as high as 12-mpg.

Summary

Fitting the pieces of a far-flung organization into a smoothly functioning system can be more demanding than assembling the pieces of an engine. But smooth functioning is the major responsibility of Bill Woody's job, within a tight cost framework. Administrative training—plus a wealth of experience—pays dividends when you're the one who specifies the parts and has to have the answers if something goes wrong. Bill Woody, like many hundreds of other fleet superintendents, knows the answers.

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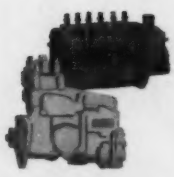
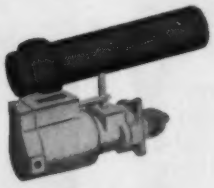
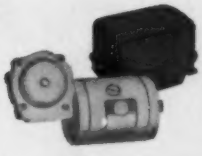


Diesel Fuel Injection Systems

Ensign Carburetion



Hydraulic Cranking Systems and Accumulators



Automotive Electrical Equipment

Magnetos and Ignition Equipment

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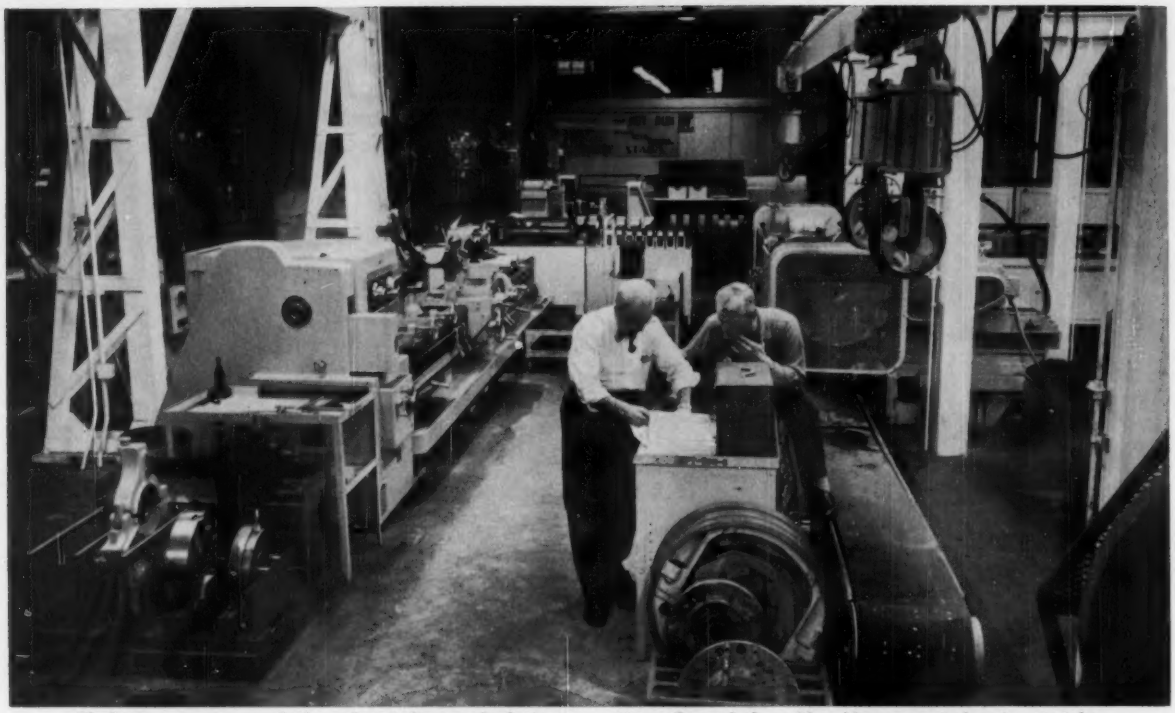


Shafts are programmed through grinding and plating operations. One of three Van Norman grinders is at right.

How EMD re-manufactures crankshafts

Crankshafts are reworked, then chrome-plated to standard dimension. Shafts carry full "new" warranty, save users money.

"We consider that our rebuilt and chrome-plated crankshafts are as good as new ones." This statement was made by Mr. John Wagner, superintendent of rebuild operations at GM's Electro-Motive Division plant, LaGrange, Ill. Supporting this contention is the fact that EMD has set up extensive crankshaft reclaiming facilities and for some months now has been rebuilding shafts.

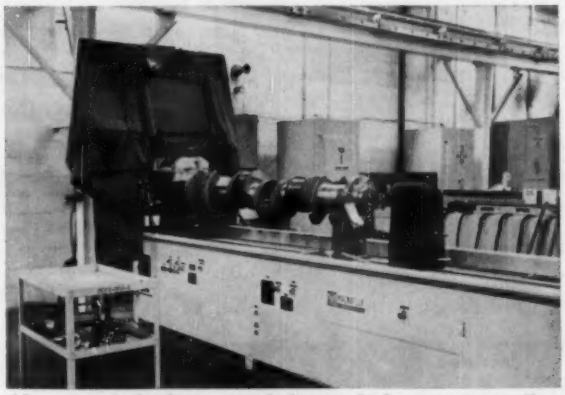
Part of EMD's motivation for getting into this rebuilding process is found in their replacement program offered to the railroads. Under the new plan, turn-in of old locomotive units on new ones is said to be more economical for the railroads than even the earlier process of re-manufacture. Replacement locomotives involved incorporate certain remanufactured long-life components (for which credit is given)—one being the engine crankshaft.

Since EMD gives full warranty with replacement locomotives they wanted the same control over remanufactured items as they had over new manufacture. Also, repair or re-manufacture of crankshafts were services they could offer their customers.

Rebuilding EMD's crankshafts can be complex, particularly when you get into the 2-piece shafts for 16-cyl engines. In addition, envisioned services ranged from rebuilding a single journal or crank pin, to rebuilding of a half shaft, up to a complete shaft rebuild. And this was to be done selectively.

Take an Old Shaft . . .

Forgings may come from the customer, from the engine of an older locomotive to be replaced or from other stock accumulated by EMD. It makes no differ-



After pre-grind, shot-peen, shafts get high-power magnaflux.

ence because unless the forging is unsound or damaged beyond all reasonable limits, it will be rebuilt to standard dimensions.

Thorough cleaning is the first step. This is done in a hot caustic bath. Normally, this will also clean oil passages but these are checked and rodded if necessary to get rid of all lube oil deposits. Now, the shaft is ready for inspection.

Visual inspection is enough to reject some forgings. Cracks or bad checks in bearing or fillet areas automatically condemn the shaft. Badly damaged fillets or gouges in bearing areas deeper than the maximum plating thickness to be applied are also causes for rejections.

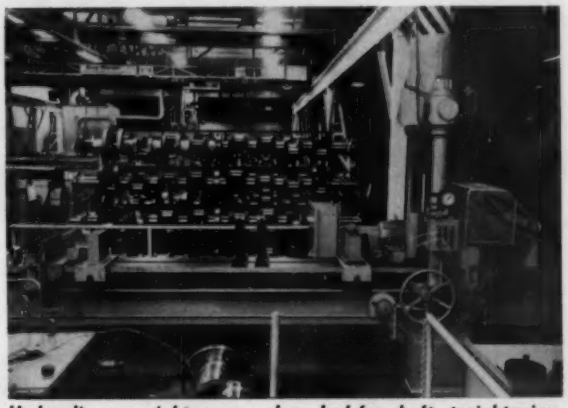
Magnetic particle inspection is then used to pick up flaws not visible to the eye. Magnaflux and Magnaglo are used. This gives pretty good assurance that the shaft is sound and worth investment in further processing. Incidentally, magnetic inspection is repeated later to insure that subsequent processing—straightening or pregrinding, for example—has not opened up or created condemning flaws.

Bearing areas are checked for hardness with particular attention to any that might show heat colors or other evidence of bearing seizure or failure. Originally, the shaft had induction-hardened bearing surfaces and while this hardness may have been drawn, this is not the main point of interest. Chrome plating will restore the required surface hardness. Main concern is that heat stresses may still be present. These are relieved in a normalizing process. The offending area is subjected to controlled heat provided by an induction heating unit and then carefully cooled.

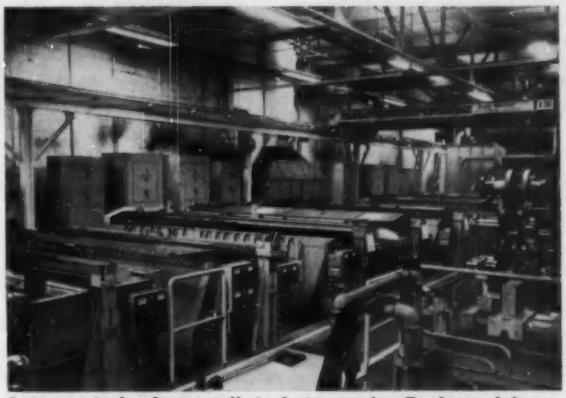
Each shaft is mounted in supporting fixtures on a surface plate for a complete check of its geometry. By the way, "shaft" unless otherwise specified, might be a complete shaft for a 6, 8, or 12-cyl engine, a complete 2-piece shaft for a 16-cyl engine or a half-shaft for a 16-cyl engine.

Shaft straightness is essential. These are massive shafts and if there is evidence of a bend, it is corrected in a special press. Long bends can need up to 20-ton pressure, short bends as high as 80-ton. Once straight and if necessary re-centered, dimensional checks continue.

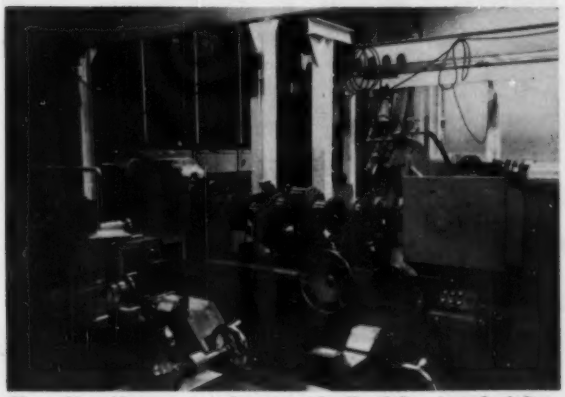
A record of conditions found are kept on a very complete inspection sheet. All journal surfaces are checked for roundness (wear is never distributed evenly) and for taper from end to end. Angular relationship of the crank throws to each other and to the No. 1 pin hole in the shaft's flange is measured to see that there's no twist. With all returns in, necessary work can be planned and all pertinent data copied onto a work sheet.



Hydraulic ram, right, moves along bed for shaft straightening.



Battery of closely-controlled plating tanks. Tanks at left are for hot alkali cleaning and for chrome stripping operation.



Three Van Norman grinders provide flexibility in scheduling.

Plated and ground shafts are dynamically balanced. Compensating bob weights shown sitting on table, lower-right corner.

EMD Crankshafts . . .

(Continued from preceding page)

Some Machine Work IS Done . . .

Worn and scored journals are not the only crankshaft troubles . . . the flywheel flange might need refacing . . . taper on the shaft-end might be damaged . . . or perhaps a counterweight suffered in an accident. These can all be repaired and are part of the job.

With the shaft straight and properly centered, facing the flange is a simple turning job. Fixing the taper is more complicated. If it cannot be salvaged by chromium plating only, the tapered section is cut off and the end of the shaft bored. A new taper section is made with an extension sized for a shrink fit with this bore. The shaft is heated and the new section frozen for assembly.

If damaged counterweights cannot be straightened they are milled off and new ones dowelled and bolted in place. This is all done very accurately. Dowel and threaded holes are checked for condition and size. If work is needed, the procedure is to plug and bring back to new shaft size.

Then comes the pre-grind . . .

All grinding is done in big Van Norman crankshaft grinders. Inspection data will tell the depth of metal removal needed for cleanup. There's quite a bit to play with as EMD goes to as high as 0.070 in. chrome plating on a side. Grinders, working with EMD-designed gauges, take the bearing down to specified diameters.

During grinding, the fillets are not touched. Only the actual bearing contact area is ground and the cut run out or faired at the ends to avoid sharp corners where stresses concentrate. Keeping the original fillets intact is very important.

Ground surfaces are then shot-peened. This shot peening is done in a specially designed machine which controls shot size, intensity and time cycle. The operation introduces favorable compressive stresses in the fillet and under the chromium plate in the journals, which improves the fatigue resistance of the crankshaft. The shot peening machine is periodically checked by means of arc heighth test specimens to insure the maintenance of the quality of this important operation.

The shaft is then again given magnetic particle inspection and cleaned in a hot caustic bath, this time with a very high-powered unit; and the shaft is ready for plating.

Putting on the Chrome . . .

Getting a dense, even chrome deposition is a matter of control—and time. There's control of the chromic acid bath concentration . . . the bath temperature. There's control of the electrical current applied. There's even control of what areas are to be plated.

Fortunately, chrome does not "throw" very far and so it is deposited primarily in the areas between the selected surfaces by the specially-designed anodes. Further limiting is done by masking. For example, no chrome plate is wanted on the fillets, in fact, these are often given a copper sulphate etch to show that no chrome has been deposited on them.

The shaft is mounted in a rotating fixture in the tank. Anodes for the mains can be stationary but those for the pin bearings must articulate like the connecting rod. Electrode-to-surface distance must be maintained by suitable spacing devices.

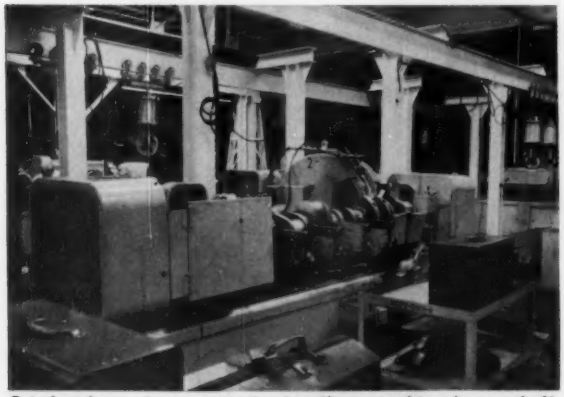
Current is then adjusted to give the desired deposition rate. EMD's rate is approximately 0.0006-in per hour. Electrode design is such that the chrome deposition is uniform. Plating to 0.007-0.008-in. oversize is enough to permit complete cleanup during grinding.

Completed plating is given a final inspection. If for any reason it doesn't meet specification, the shaft goes to a de-plating tank (current direction reversed) where it is removed. The surface is carefully examined to see if it's contributing to the bad chroming. Whatever the trouble, after its correction the shaft is plated again.

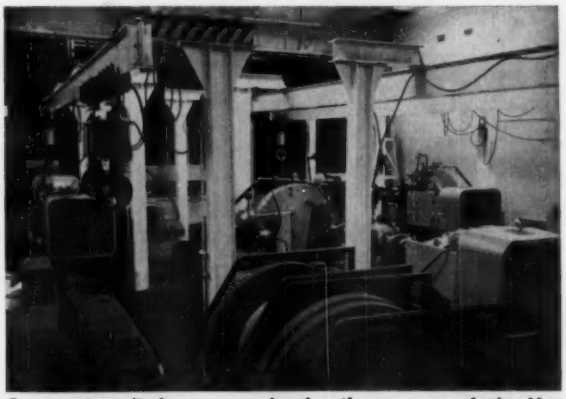
Now, the Final Grind . . .

Here is where all previous work pays off. The shaft is straight and properly centered . . . It now has enough metal to grind it to "new" tolerances. Deflection in long shafts due to weight is prevented by the overhead Van Norman compensators that automatically maintain alignment. Steady rests hold the shaft against grinding wheel pressures.

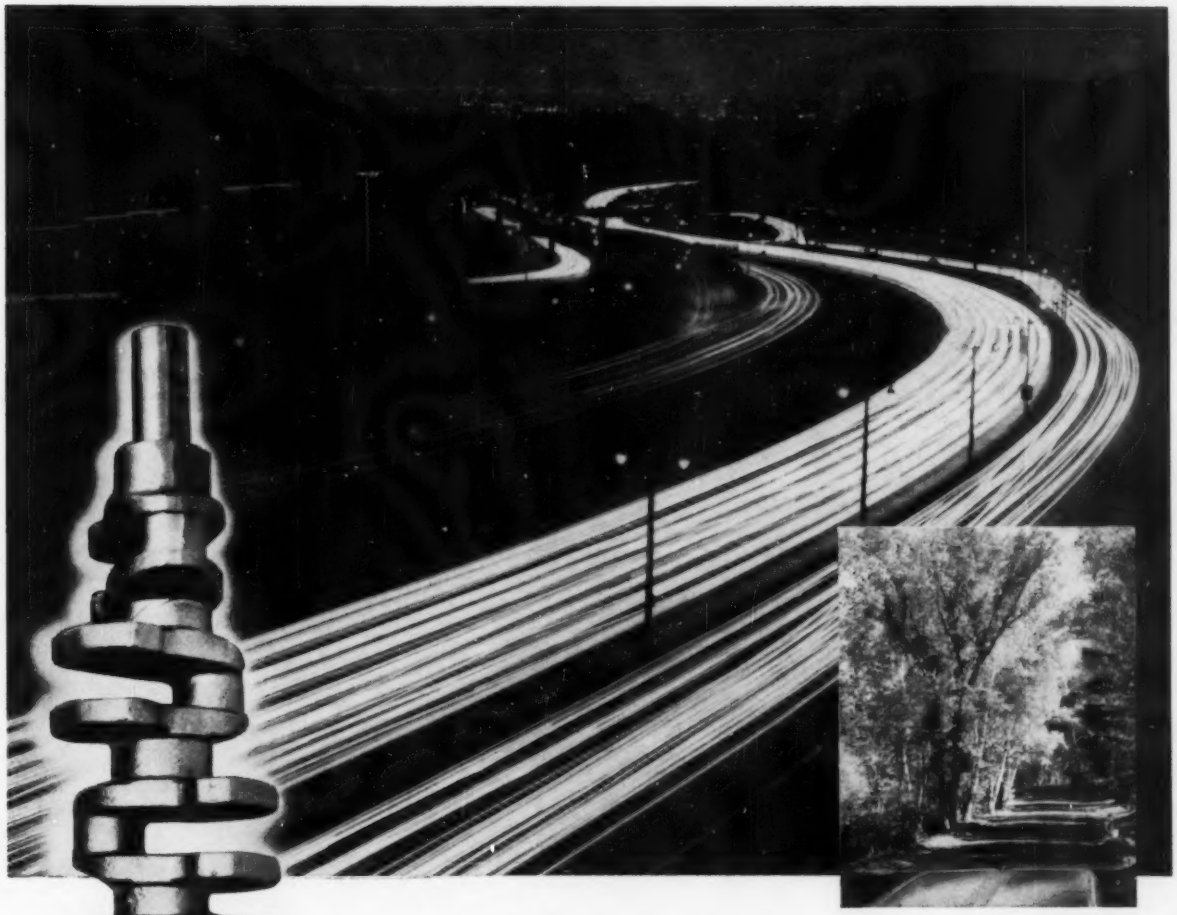
(Continued on page 44)



Grinders have the capacity for handling anything from a half-shaft to the complete two-piece shaft for the 16-567 engine models. Lift gear makes handling the shafts convenient, easy.



Pneumatic cylinders on overhead rails are part of the Van Norman compensating system that automatically supports long shafts. This is necessary to keep the shafts free from sag.



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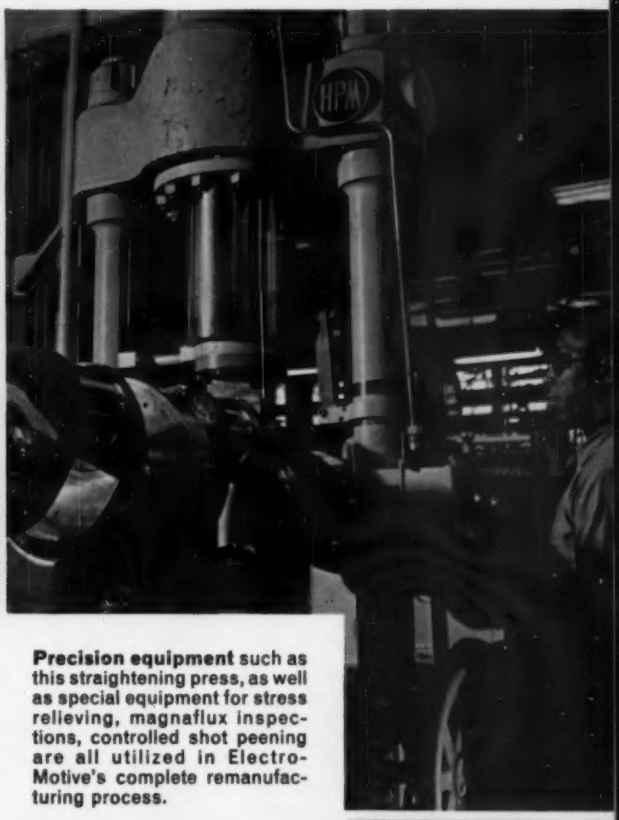
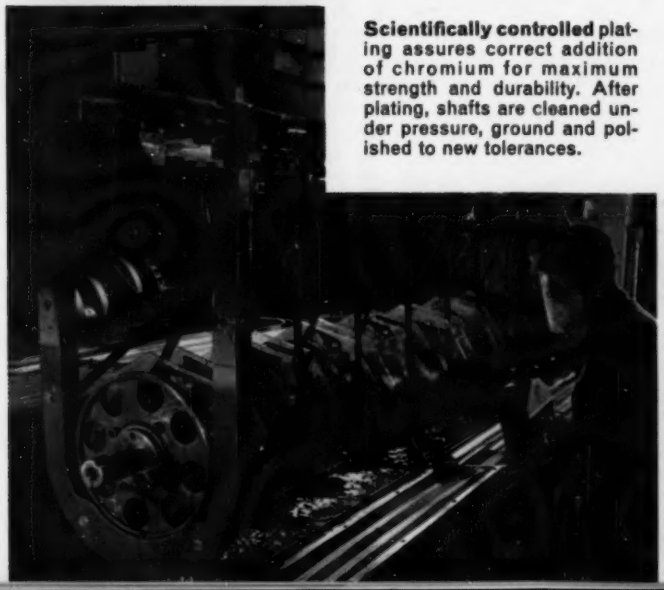


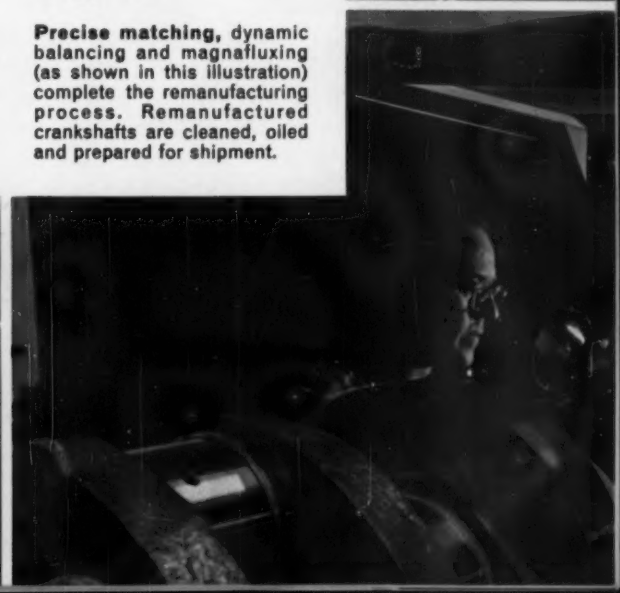
Crankshafts are first thoroughly cleaned and given a polish to facilitate inspection. *When necessary*, damaged tapered ends are replaced, counterweights added, couplings straightened, pilot concentricity restored.

Precision equipment such as this straightening press, as well as special equipment for stress relieving, magnaflux inspections, controlled shot peening are all utilized in Electro-Motive's complete remanufacturing process.

Scientifically controlled plating assures correct addition of chromium for maximum strength and durability. After plating, shafts are cleaned under pressure, ground and polished to new tolerances.

Precise matching, dynamic balancing and magnafluxing (as shown in this illustration) complete the remanufacturing process. Remanufactured crankshafts are cleaned, oiled and prepared for shipment.





PERFECT CIRCLE PISTON RINGS ARE INSTALLED AS ORIGINAL FACTORY EQUIPMENT IN 94 BRANDS OF VEHICLES AND ENGINES. AND, MORE AWARD-WINNING FLEETS USE PC RINGS THAN THE NEXT FIVE BRANDS COMBINED

WHY THE PROS PREFER PERFECT CIRCLE PISTON RINGS...

NEW TRI-COIL OFFSET SPRING

INCREASES DRAINAGE, CUTS CLOGGING

The new stainless steel spring in Perfect Circle's OS89 heavy-duty oil ring is offset in a channel next to the drainage slots, instead of being directly behind them.

As a result, drainage is completely unobstructed by the spring, and clogging is reduced to a minimum.

And, this amazing new spring is made of 3 interwound coils. The unique design makes possible great strength and durability in a smaller diameter. There's also a greater area of contact with the ring all the way around for more uniform pressure, greater conformability and less friction.

Only Perfect Circle has this new type of ring that reduces clogging for better oil control in heavy-duty engines.

For an informative booklet on the new OS89, contact your PC supplier or write to Perfect Circle, Hagerstown, Indiana.

PERFECT CIRCLE

PISTON RINGS • POWER SERVICE PRODUCTS

HAGERSTOWN, INDIANA · DON MILLS, ONTARIO, CANADA

THE DOCTOR OF MOTORS
Skilled mechanics the world over prefer and install Perfect Circle piston rings

Electric retarder saves service brakes

Lear retarder allows faster downhill speeds safely lowers maintenance costs . . . reduces cycle times

Retarders have contributed to significant reductions in maintenance costs while simultaneously contributing to higher unit productivity. Downgrades can be handled safely at higher speeds with retarders. This shortens trip times. Service brakes are normally not required except for full-stop. Less-frequent brake application means less wear and lower maintenance costs plus cool brakes and drums ready to meet emergency.

Though service brakes have been steadily improved to meet requirements of stopping from today's higher operating cycles and heavier loads, the forces that control stopping are the same. Braking effort to stop a vehicle increases as the square of the speed. Double the speed, four-times the braking effort required.

Because of limitations on service brake effectiveness in continued use, down-hill speeds must be kept relatively low. Retarders can absorb the accelerating forces without change of effectiveness even at high retarding loads. Thus, higher down-hill speeds are possible with the service brakes still in reserve.

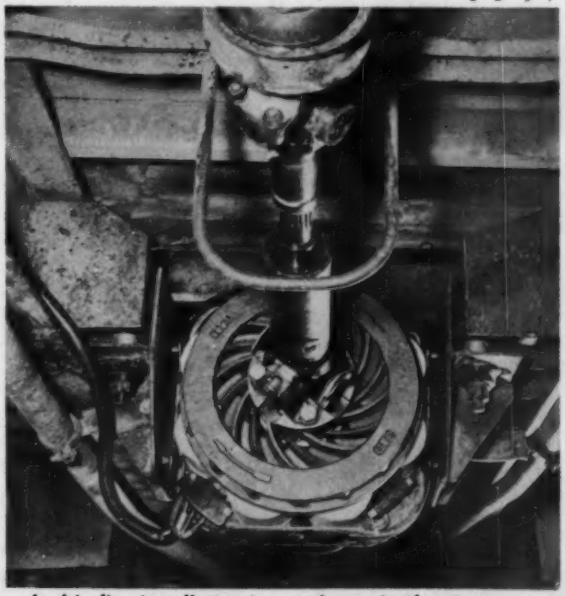
For the past twelve years one such unit has been used in France—to the extent of 4500 units—under the name "Thelma". U. S. licensing has been granted, and Thelma is being produced in this country as the Lear Electric Retarder.

Oversimplified, Lear's Electric Retarder works as if a generator were cut into the drive line. This "generator" is an eddy current type of machine, utilizing the driveshaft as a prime power source. In other words, the retarder is a "generator" that produces as a final product, heat.

Development of this type retarder is a logical consequence. Some years back it was reasoned that if these eddy currents provided electrical resistance to turning a generator armature (input power required) why not use them to retard a gravity-driven shaft that has to be slowed down.

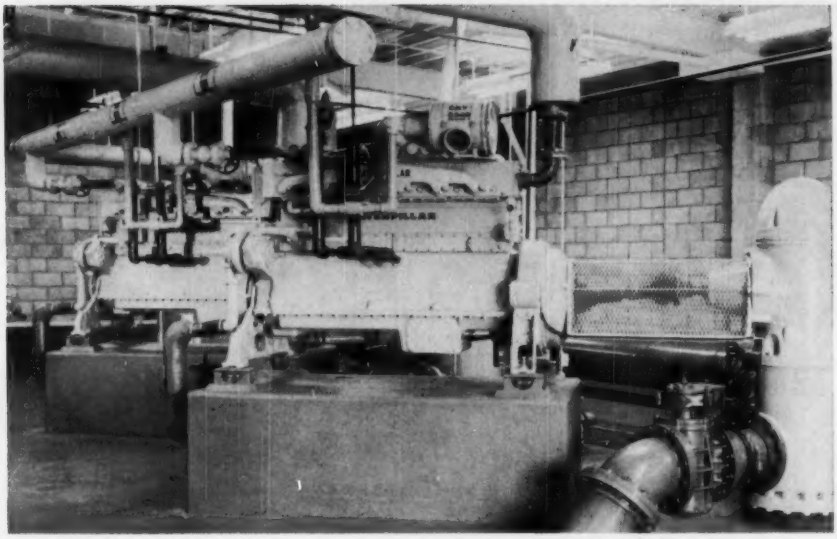
In the case of a heavily-loaded truck on a downgrade, gravity overcomes rolling resistance and tends to accelerate the vehicle. Service brakes normally apply friction to balance this tendency. If an equal

(*Continued on page 36*)



In-driveline installation is out-of-way, in the air stream.

High-Temperature Cooling for Diamond Bar's Pumpers



Water company saves power, avoids possibility of water supply contamination with Vapor Phase cooling

Diamond Bar Water Company, which will serve the planned city of Diamond Bar in Southern California, has turned to ebullient-cooled natural-gas engines to power turbine pumps at the company's new booster pump plant. This is contrary to the normal practice of using electric motors for driving booster pumps. Caterpillar natural gas engines and Vapor Phase cooling system were specified after analysis determined natural gas power to be cheaper, more flexible, and more reliable. Engines selected were Caterpillar G342 Series C.

Ordinarily, Vapor Phase cooling is used for one of several reasons. If a "sour" gas fuel or a high sulfur liquid fuel is to be used, high combustion chamber wall temperatures prevent condensation of water vapor, a by product of combustion, in the cylinders. This condensate, with formation of sulphuric, nitric and carbonic compounds, forms acids contributing to corrosive wear.

Another use is for waste heat recovery. The Vapor Phase cooling system provides a ready source of steam. Third, a thermosyphon cooling system offers possibility of reducing parasitic loads from the engine, water circulation pumping for example. These are probably the three most obvious advantages of Vapor Phase cooling.

At Diamond Bar, only the last advantage was considered; but a fourth factor was introduced. Decision to provide Vapor Phase cooling resulted from a need to eliminate any possible contamination of the domestic water supply. This ruled out a heat exchanger system. When, in addition, analysis of costs in terms of horsepower loss required by normal self-contained engine cooling systems favored the Vapor Phase cooling technique, the decision was made.

Why Vapor Phase Cooling . . .

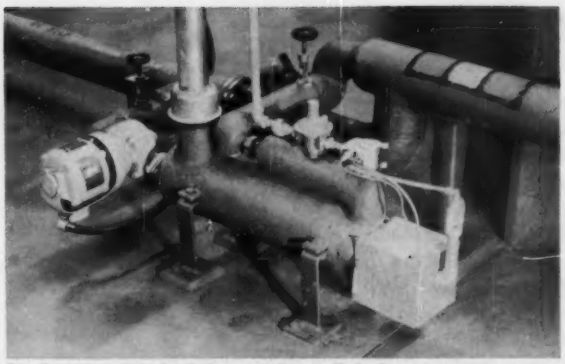
Let's look at the costs of cooling an engine in terms of engine horsepower first. The fan and water circulating pump normally used to cool an engine of this size draw from 7½ to 10-hp off the top of the engine. With Vapor Phase cooling system, all but two of this horsepower loss is salvaged by relying largely on thermosyphon circulation. In this installation, a small centrifugal pump has to be used as an auxiliary to move the water through the engine. More on this later.

Two horsepower (of that salvaged 7½ to 10-hp) is used in powering electric blowers in the Vapor Phase cooler. In the cooler at Diamond Bar, the steam is converted to condensate for recirculation through the engines, eliminating in large part the need for make-up water.

A second major consideration was that ebullient cooling also avoided water contamination possibilities

that could develop in a pumped-water heat exchanger installation. A break in the heat exchanger bundle that would be located on the discharge piping from the booster pump, could cause extensive contamination by draining the engine cooling system (with any rust inhibitor, anti-freeze, sludge, scale, etc.) into the partial vacuum set up in the waterline. In sanitary water engineering parlance, this is known as a "cross-connection," something to be avoided. The Vapor Phase system of cooling obviously eliminates this weakness.

These, then, were the prime considerations behind the use of ebullient cooling in the Diamond Bar Water Company booster plant. Natural gas engines would, in this instance, be the most economical form of power. Once decided, a number of other devices were designed into the system to make it compatible with irregular pumping demands.



Pre-heater, with firebox at right, Bell & Gossett motor pump, General Controls thermostat, Minneapolis-Honeywell shutoff.

Installation Details

Each of the two engine-pump installations move 1250-gpm against a 490-ft head to a 4-million gallon reservoir in the hills several miles away. When the reservoir signals for more water, the Caterpillars have to respond almost instantly.

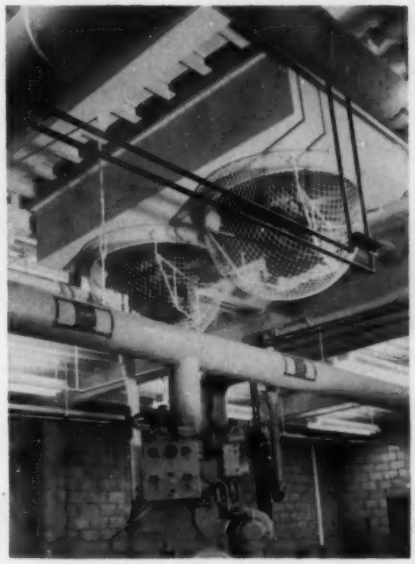
To assure rapid starting and instant availability of full power output, the engines are maintained automatically at a nominal 175°F temperature. This is done by engine water preheaters tied into the circulating system of each engine. Heaters have a gas burner and associated electrical circulating pump that are operated automatically by thermostats to hold the water temperature within preset limits around 175°F. Being near operating temperature, the engines start easily and accept full load as soon as started.

When using the Vapor Phase system (ebullient cooling), heat rejected by the cylinders to the cooling water is removed in the separator unit by the process of the water flashing to steam. This change of state from water to steam involves the latent heat of vaporization phenomenon in which the change of state from water at a given temperature to steam at the same temperature requires roughly 1000 Btu's per lb. This heat is extracted from the water, keeping its temperature constant. At standard atmospheric pressure, this temperature will be 212°F. Changes in the amount of heat rejected to the water will not affect its temperature, only the amount of steam formed. The temperature of the water can be changed by pressurizing the system. The higher the pressure, the higher the boiling temperature.

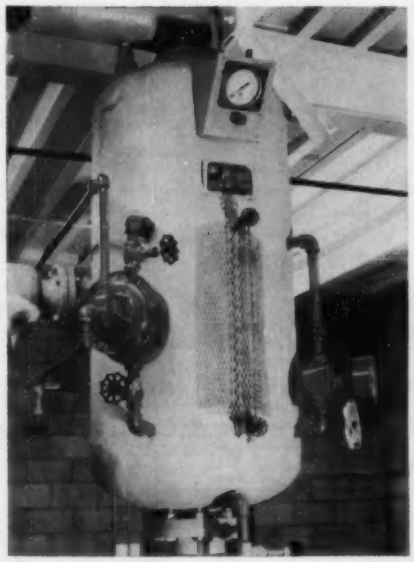
Steam produced in the cooling process can be used as steam for heating, process work, etc. In this case, make-up water must be continually added to the system. Or, the steam can be condensed in a cooler and the condensate recirculated through the engine, such as at Diamond Bar.

One advantage of this high temperature cooling system is that engine temperatures are held constant regardless of load. Also, temperature from the bottom to the top of the engine is uniform, inlet to outlet temperature difference usually being about 2°F.

Another advantage is that the cooling water temperature, being high, keeps the combustion space above



Two fan coolers mounted in roof draw 1-hp each, giving a net saving of 7 to 9-hp per engine.



Vapor Phase system separator includes pressure gauge, a water glass and float-controlled make-up water system. Unit has capacity to handle four G342 Cats.

High Temp Cooling . . .

(Continued from preceding page)

the dew point of approximately 194°F. If condensation of water vapors formed as a by-product of combustion is eliminated, there is no formation of acidic materials as occurs when "sour" gas or high-sulfur fuel oils are used. In many installations, this has proven extremely helpful in eliminating severe corrosion problems.

Because Diamond Bar has no immediate need for the waste heat that could be recovered as steam, the system was not pressurized to operate at the higher-than-normal boiling temperature. Even this atmospheric operation will give protection against formation against acidic materials in the cylinders, although no corrosion problems were anticipated since a good, dry gas is being burned.

The insulated steam and water lines for the Vapor Phase system are suspended from the ceiling with spring hangers. During summer weather, water discharge temperature from the engines will be about 218°F and input temperature of the condensate will be 210°F.

Design of the building housing the installation presented a complication. The top of the steam separator unit could only be located approximately four feet higher than the top of the engine. This resulted in a hydrostatic head (about 18-in.) too low to assure proper thermosyphon action. A small circulating pump was installed on the engine block as an assist. Steam relief lines were tapped into the water jacket to prevent formation of steam pockets and resulting hot spots if there should be any separation of water and steam following pump discharge.

Fully automatic control of the plant is still some way off. But a Murphy safety switch and control panel installation provide for automatic shutdown in the event of improper water temperature, low oil pressure, or vacuum. The shutdown acts through a gas line valve that automatically shuts off fuel. It must be manually reset before engine operation can be resumed.

Particular attention was given to noise and vibration. Result was construction of concrete engine bases mounted on two inches of cork, and isolated further from the surrounding five-inch thick floor by an additional inch of cork. Hospital-type Maxim silencers squeeze all but a soft rumble from the exhaust system.

Summary

The plant supplies Diamond Bar's power requirements economically. All but a few engine-horsepower are available for pumping, and separation of cooling water from pumped water protects the city's water supply against possible contamination.

The use of natural gas engines and ebullient cooling are only two of a number of features that establish this small plant as one of the most interesting in the country. The layout and design of the engine and pump facility, the provisions for converting it to full automatic operation and the all-new distribution system it serves, combine to make Diamond Bar Water Company unique any way you look at it.

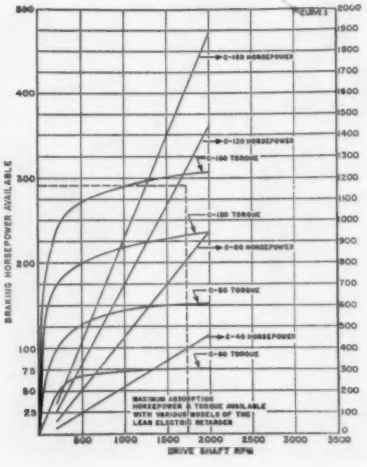
Electric Retarder . . .

(Continued from page 33)

amount of "friction" or retarding effect could be applied to the axles or the driveshaft, say, by a retarder, speed would be constant and service brakes would be used only for stopping.

Operation

To do this, Lear's retarder contains two main elements; a stator and a rotor. The stator is fixed to vehicle chassis, while the rotor is driven by the vehicle's drive shaft. There is no physical connection between rotor and stator.



Various capacity models are available to meet varying needs.

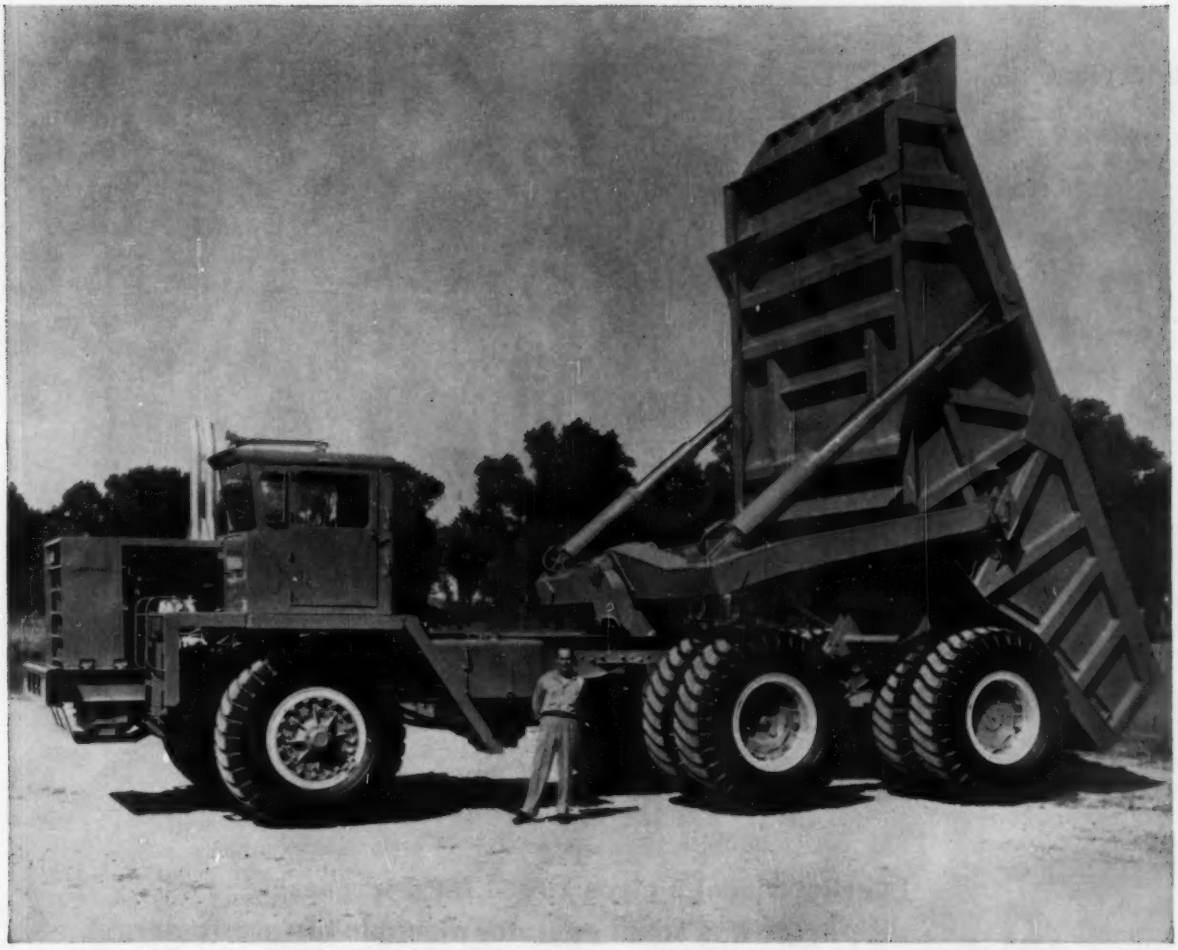
The stator consists of a series of electromagnets. The fields can be energized by electrical current from the vehicle's electrical system. A 4-position handle on the steering column controls the amount of excitation, which in turn controls the degree of downhill-induced speed absorbed by the retarder. Once the control is fully actuated, full retarding torque develops in two to three seconds.

The rotor, connected by a shaft that rotates inside the stator, consists of two steel discs. Until the stator magnets are excited, the rotor spins freely. Once, however, a magnetic field is induced, the steel discs absorb shaft energy to cut the field, absorbing energy. Any electricity produced is dissipated as heat.

Each rotor disc is heavily finned, providing a large surface area to dissipate this heat. Turbulence in the surrounding air is also created to help carry the heat away. With acceleration balancing deceleration, the speed of the vehicle is controlled, and without the service brakes.

Summary

In operations such as logging, involving heavy-load mountainous trips, retarders have proved themselves to be time and equipment savers. As they become more highly developed and better understood, they are finding even wider application.



Ni-Resist parts help cut operating costs in the world's largest production model truck

Ni-Resist* diesel engine parts withstand high operating temperatures ...deliver long, cost-saving service in this 700-hp turbocharged giant

This KW-Dart 95-tonner has a carrying capacity of 48 cubic yards. Powered by a 12-cylinder, 700-hp Cummins Turbodiesel** engine, this giant is designed to haul bigger loads at lower cost.

To achieve peak efficiency and fuel economy, the heavy-duty diesel operates at temperatures above 1200°F. And to assure long service life of engine components exposed to these high temperatures, Cummins specifies Ni-Resist nickel-alloyed austenitic cast iron.

Ni-Resist manifold is indestructible. Ni-Resist iron withstands hot, corrosive exhaust gases that tend to warp and crack ordinary irons. That's why Cummins considers the Ni-Resist manifold to be virtually indestructible. For the same reasons, the rugged turbocharger casing is also made of Ni-Resist iron and can be expected to deliver years of trouble-free service.

Ni-Resist piston ring inserts have excellent wear resistance, can take the pounding punishment of high-compression operation. They prevent power-wasting "blow-by" and avoid needless oil consumption.

If you build or use heavy-duty diesel engines, specify engines with Ni-Resist parts. You'll be specifying power *and* economy.

*Registered Inco trademark
**Registered trademark, Cummins Engine Company, Inc.

700-hp Cummins Turbodiesel delivers maximum power at lowest operating costs—uses Ni-Resist austenitic iron parts to assure long service life at high temperatures in this efficient turbocharged engine.

THE INTERNATIONAL NICKEL COMPANY, INC.
67 Wall Street New York 5, N. Y.

NI-RESIST

NICKEL-ALLOYED IRONS PERFORM BETTER LONGER

Interview:

Cerlist repowered Ford-Transit bus gets 11 mpg . . . 2-speed axle gives 60 mph!

M & B Transit Reaps Repowering Benefits

Cerlist Model 3 gives 100% MPG increase . . . helps this small operator maintain his profit margin.

Diesel Power paid a call late last month on Alex Foushee, Assistant General Manager of M & B Transit Company of Burlington, N. C. M & B is what you might call an average American city bus company. They operate 21 buses on a 16-mile run between Graham, Burlington and Elon. And, like many other small business today, M & B found themselves caught in an alarming price squeeze, profits down . . . costs up. So they turned to Cerlist to see if diesels couldn't do something about it.

"Mr. Foushee, which of your 21 buses did you pick for the switchover to diesel?"

"Well, we put the Cerlist Model 3 into one of our Ford-Transits. It's a 1946, 27 passenger. We also put them into a couple GMC Model TGH's, 27 passenger and 31 passenger. Believe it or not, the Ford-Transit took less than 30 man-hours to convert. And the GMC's of course, took even less time because of their removable engine support frame."

"What about the Ford-Transit conversion—how'd it go?"

"As I say, took only 30 hours. People right here in our own shop did it. Cerlist supplied the conversion kits . . . and sent some of their people along to help on the initial conversion.

"First of all, we removed the gasoline engine's flywheel, machined it, and bolted it directly to the new diesel's flywheel. Clutch bell housing came next—we re-drilled it and machined a centering shoulder against the ID of the flywheel housing. Original clutch (with new lining) was mounted and then we were ready to bolt the bell housing and transmission into place.

"You're probably wondering about engine supports—well, we modified the original supports and put on Lord engine mounts. As for the fan, we wanted it to remain at its normal location on the diesel, co-axial with the water pump. We installed a new radiator. Next, we fixed a bracket to support the brake air compressor—it's driven from a vee-belt pulley adaptor on the crankshaft pulley. After that there were just a few odds and ends remaining—mounting the dry air filter . . . adapting the throttle linkage . . . installation of a return fuel line . . . simple wiring for glow plug and we were through.

"As I say, men in our own shop finished it up inside of 30 hours. I'd say they should be able to better this time on the next conversion!"

"How's it doing—pleased with its performance?"

"Pleased as punch! As you know, the Cerlist Model 3 is rated at 85-hp at 3000-rpm. Piston displacement is 170-cu in. Compact size means she'll fit with room to spare in engine compartments. And that high-speed range means you don't have to worry about changing transmissions or axle ratios. It's a good little diesel for our operation—pulls better and (believe it or not) has better acceleration than the old gas engine we took out!

"Best of all, we like the kind of fuel consumption we're getting. Our fleet fuel bill is a big, big part of M & B's monthly budget—so you'll understand that we're mighty pleased to see miles-per-gallon for the diesel operation climb to 11½mpg as compared with 5½-mpg with the original gasoline engine on the same bus route! And, by the way, the GMC's are getting equally good mileage with the Cerlist Model 3."

"What about maintenance, Mr. Foushee?"

"It's lower—that's for sure. In fact, looks like after the fist six conversions we'll be able to move one of our mechanics to another department. We're saving money on plugs and points . . . and saving ourselves the time it takes to service these items! No more valve jobs . . . or ignition and carburetor problems, either."

"What about overhauls—are they going to be harder or easier?"

"Well, first of all, we're figuring 3 to 5 times the mileage from our new Cerlist engines before major overhauls. Those gas engines seldom gave us more than 30,000 to 50,000 before we had to tear them apart. And, of course, these Model 3's are easy to work on when you do finally have to major 'em. Take the individual aluminum heads and removable wet liners, for instance . . . and you can pull the exhaust manifold for a quick, easy look at your liners, pistons, rings and pre-combustion chambers. But she's built rugged, and we're not anticipating any real trouble until around the 200,000-mile mark."

"What about oil consumption?"

"It's good! Our Cerlist conversions have been averaging 1-qt of oil per 1000 miles. And for the type of service we give them this is good, real good. Our gasoline engines, even after break-in, normally use 2-3-qt per 1000 miles! That 1-qt figure for the diesel should be even lower after the engine's finally broken in. Our normal oil change period is every 2000 miles."

"Your bus drivers—how do they feel about your switch over to diesels?"

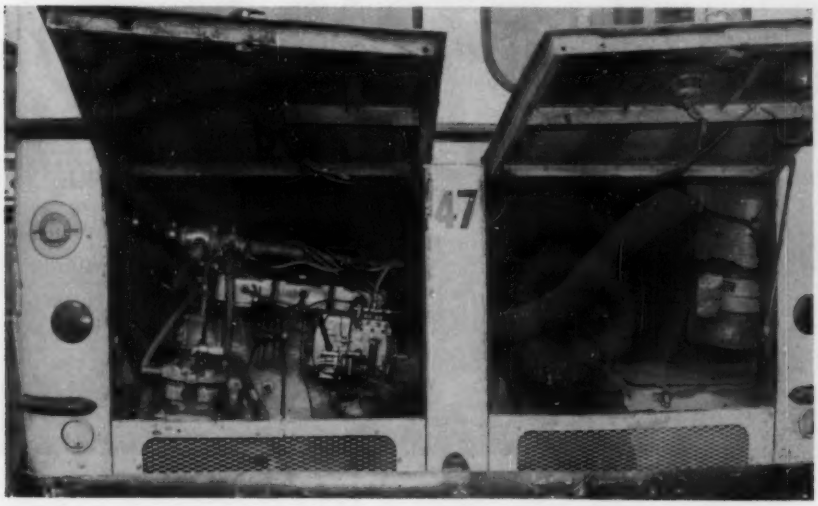
"Well, as you know, drivers are interested in route time. (And, for that matter, so are we here in the office!) Well, our converted buses are getting equal route times . . . and, in some cases, are actually making better times! We've got a 2-speed axle on one of the Ford-Transit buses. In high-range, she'll move right up easily to 65-mph. It's good on inter-city charter service—and, as you may know, this is an important source of income for our operation. It's a type of service, incidentally, which would normally require heavier, more expensive equipment. But our diesel powered Ford-Transits are doing it and doing the job mighty nicely!"

"How does it look to you—more conversions coming up?"

"I'd say, definitely. These small, lightweight high-speed diesels offer transit fleet operations like us—with 27 to 31 passenger buses—the answer to the cost-profit squeeze. We now have three buses powered by Cerlist Model 3 Diesel. A fourth bus is currently being converted and we have on order three more Model 3's for delivery this month."

"One final question, Mr. Foushee. How soon do you expect to pay off the conversion cost?"

"Our top routes now average 3000 to 5000 miles per month. On that basis, conversion cost, we figure, should be amortized in fuel and maintenance savings within a year—18 months at the most! From our experience I'd say just about every gas bus in the country is a diesel-conversion candidate."



Cerlist's 3A drops in easily on Ford-Transit bus. Conversion kit is available for this engine to replace the 254 cu in. gasoline engine.

Diesels Power Missile Launchings

At Cape Canaveral, F-M diesels go on the line to supply all power and water to protect the pad.

"People seem to think that a missile shoots right up, but it doesn't—it just sort of floats the first part of the way". This remark was made by Hugh Godwin. the Fairbanks-Morse salesman who sold the power and pumping equipment for the Cape Canaveral launching pads to the Corp of Engineers. That's right, diesel engines at a missile launching site.

While missiles and missile launchings are the glamorous part of the operation, the old-reliable diesel engine still does the back-up work that makes it all possible. They do two things—provide electrical power and pump high-pressure water. Why water? Many people think that it is smoke that billows up on launching. Not so, its steam, the effect of blast heat on the water used to cool and protect the launching pad.

There are three diesel engine installations on the Cape Canaveral base: one generating station and two pumping

The smoke from a blast-off is steam, the product of rocket engine heat and water, pumped by diesels, that protects the pad.

stations. All are powered by Fairbanks-Morse diesel engines. The power station has two 1000-kw generators coupled to an equal number of 10-cyl 38D8 ½ engines, and three 500-kw units driven by 6-cyl 38D8 ⅛ models. During a launching or during line test, when a missile engine is run up with the missile held to the pad, these generators supply all current requirements. They, with the pumping stations, offer the dependability required for an operation of this complexity. The same is true for the water pumping system.

There are two pumping stations. At the first, five 825-hp 38F5 ¼ engines drive five single-stage horizontal split-case pumps. At the second pumping station, near the other end of the Cape, are eight similar units.

These pumps have a capacity of 5000-gpm at 410-ft head, and deliver 150% capacity at 65% head. Engines can be started and stopped individually by remote control from a central control panel in the pumping station. This is an important consideration during a launching, for firing a missile requires a lot of water.

Firing a Missile . . .

When a firing from one of the Cape's pads is scheduled, the diesel engine men prepare for what may be a long wait. Sometimes countdowns are interrupted. During one, the engines were on the line for seven hours. Complexity of the operation requires extensive component check-off—and of course, the countdown. Any unplanned interruption of sequence, or delay, results in cancellation because of the possibility of misfire. Thus, power requirements have to be 100% reliable. With this as a primary condition, diesel-driven generators, located close at hand to eliminate extended power-lines, were selected because of their dependability.

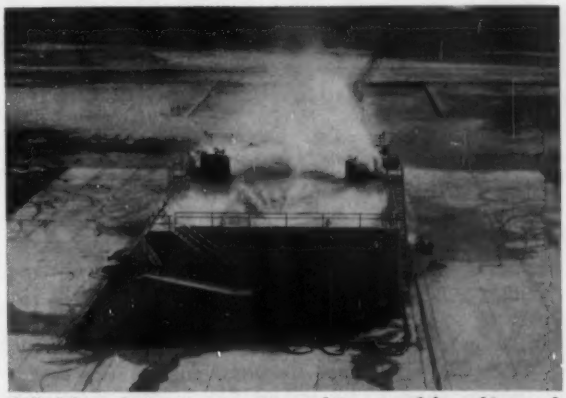
Early in the countdown, switches are thrown to feed launching-pad power requirements from the diesel-driven generators to eliminate possibility of power failure at a critical stage. In addition, the pumping stations bring the diesels on the line ready to supply water.

Water, in volume at high pressure, plays a necessary role in every launching. When the missile is fired, amid a cloud of billowing "smoke", the "smoke" is actually steam caused by the flaming trail of the missile directed against the launching pad. This heat, if not insulated out and carried away, would burn out the pad's cable tray. In addition, spilled fuel and liquid oxygen would be a hazard unless washed away. The missile's flaming trail is directed onto a water deluge.

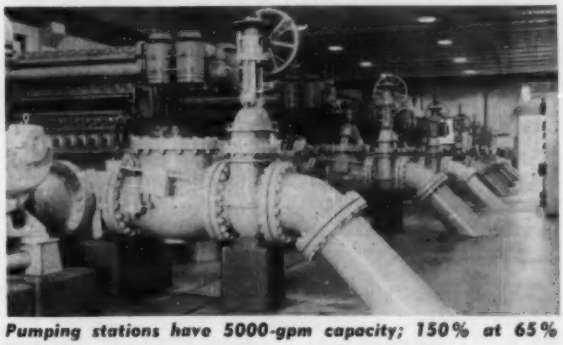
Deluge is provided by the pumps, which deliver high-pressure water over the pads into a blast bucket at the base. The deluge, sprayed at 175-psi, sprays through hundreds of holes drilled in the blast deflector plate. The water, heated and loaded with volatile contaminants, then empties out the back into a concrete pond. Flowing at 30,000-gpm, it carries away most of the heat and washes away all of the spilled fuel and liquid oxygen.

The fire-protection system, lines and nozzles around the top of the pad, works off this same high-pressure system. Fire protection system consists of three fog and three deluge nozzles, controlled from within the blockhouse. These direct downward, onto the pad. Once, in '57, when a Thor rose only six inches, then fell back on the pad, the fire protection system handled the emergency. In this one instance, missile and missile launching pad costs being what they are, the diesels paid for themselves. More important, it saved missile development time!

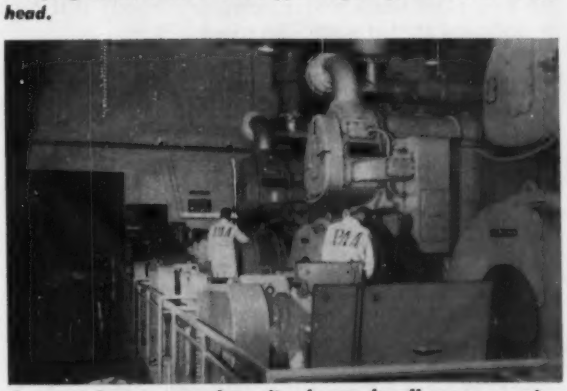
These diesel-powered installations—power and pumping—have saved, according to one missileman, "maybe a year or more when you consider accidents on pads up and down the line". As with any diesel, saving is in money, too. Pads can be reused, are not damaged even when testing a missile engine with the "bird" held to the pad. As for reliability—that's why they specified diesels.



Full deluge drains to concrete pond to rear of launching pad.



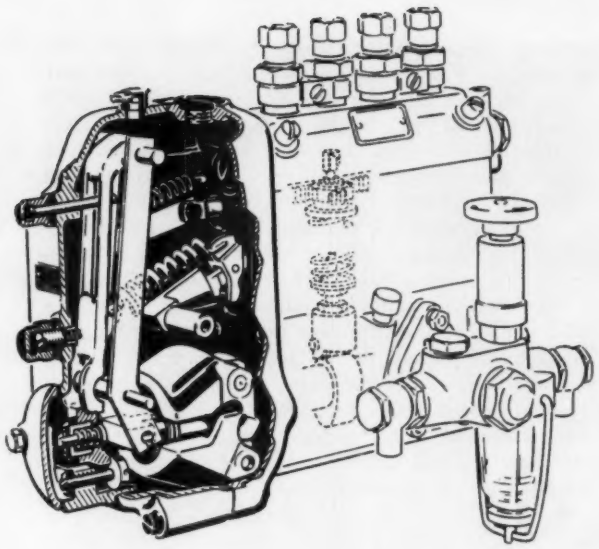
Pumping stations have 5000-gpm capacity; 150% at 65% head.



As countdown approaches, diesels supply all power requirements.

Product Report:

Robert Bosch's "RSV" Governor



Variable-speed mechanical governor meets wide applicational needs with standardized components

In their RSV variable-speed mechanical governor, Robert Bosch has come up with some interesting features and important benefits. Both features and benefits relate to the governor's performance and the flexibility of its adaption to different engines with different operating characteristics. And this is done with a unit having standardized components.

First, why governors? Gasoline engines don't generally use them. The reason lies in the difference between the characteristics of an injection pump and a carburetor. Remember, however, that the function remains the same—*to program the delivery of fuel as closely as possible to the ability of the engine to use it.*

A variable-speed diesel governor must also compensate for load variations and hold engine speed within set limits at any throttle setting. The limits are the "percent regulation," and can be expressed by the formula.

$$\% \text{ Regulation} = \frac{\text{No-Load rpm} - \text{Full-Load rpm}}{\text{Full-Load rpm}} \times 100$$

This applies at any engine speed as determined by throttle position. "Full-Load" in this case means the full load (maximum torque being developed) that can be obtained *at that particular speed.*

The diesel governor has another function. In a carbureted engine at a given throttle setting, air friction in the induction system builds up with increasing rpm so as to automatically cut back on fuel delivery at the jets. But in a diesel at a fixed rack setting, fuel delivery increases as rpm's go up. In other words, once engine rpm gets beyond the speed at which best volumetric efficiency occurs, the weight of air per stroke is going down while the volume of fuel is going up. This explains why it is desirable to have a governor to modulate fuel delivery in accordance with the engine's ability to use it.

Here, then, were two major design objectives: to provide close speed regulation throughout the engine's operating range; and to program fuel delivery in accordance with the engine's ability to use it efficiently. A third objective, and probably the most difficult to meet, was that the first two requirements had to be satisfied using essentially a standard governor, even though applied to a wide variety of engines with different operating characteristics.

To do this with a standardized unit it was necessary that it have adjustable percent regulation. It was also desirable to cover the broad field of application anticipated without need for changing springs and using complex spring packs. Standardization not only simplifies and reduces cost of manufacture but also simplifies parts inventory and servicing problems in the field.

RB engineers achieved these results in a design using a single governing spring. Modulation of fuel delivery with increasing engine speed is accomplished by an adjustable adapter spring (this acts as a "torque capsule") and an adjustable supplementary idling spring can be used to insure good idling performance. Through adjustment of the springs and normal stops, governor performance can be varied to meet most operating requirements.

How the RSV Works . . .

Three governing conditions will be described to show how the governor operates — starting, at idle, and at two conditions of full load. The diagrams used will show the components and their interrelationship as well as their functions.

Starting—It has been found that engine starting is aided, particularly as ambient temperatures go down, if well-in-excess of full-load fuel quantity is injected. Now see Fig. 1. Movement of the control lever to the "Start" position (beyond full-load position) tensions the governing spring, pulling the tensioning lever against the full-load stop. Lugs of the swiveling lever (when in this position) release the guide lever. This permits the starting spring to pull the floating lever and the attached control rod beyond the full-load point into the starting position.

Starting quantity of fuel is injected as the engine is

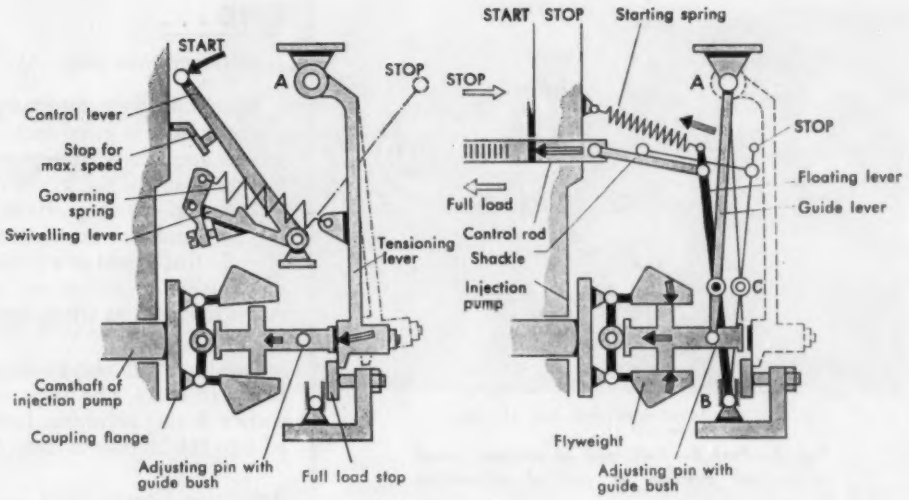


Fig. 1—Starting process is shown in two phases, however in reality they almost coincide. Only parts involved in each phase are shown.

cranked. Once started the control lever is moved back to the desired operating range, say, a fast idle for warm-up.

Idling—Note in Fig. 2 the action of the control and swiveling levers when moved from start position (1) to idle position (2). *Not only is spring tension altered but its effective lever arm is changed.* This combined action occurs throughout control lever movement from idle to full-load position. This has the effect of providing the correct spring rate for the desired percent regulation throughout the operating range.

Spring action on the tensioning lever is now soft, permitting the flyweights to move outward even at low speed. They are thus sensitive to minor speed changes and through movement of the adjusting pin and guide bush, the floating and guide levers, and linkage, move the control rod to hold idle speed within the required percent regulation.

During idle, forces are low and the adapter spring or torque capsule is only slightly (if at all) compressed. Thus, outward movement of the flyweights soon brings the tensioning lever in contact with the supplementary idle spring. Effect of this opposing force is to promote idle control sooner. In case of excessive speed drop, even the soft starting spring participates in moving the control rod quickly to provide more fuel.

Full Load—As mentioned, full load can occur at any engine speed and means that the maximum torque available at the speed is being developed. However, the engine's peak torque usually occurs at some intermediate point in the speed range. Somewhere above this point the engine's volumetric efficiency (air entering per stroke) will begin to fall off, while as speed increases, the injection pump's delivery, even at fixed rack, is increasing.

Basically, then, the problem is to provide maximum fuel at the intermediate speed where peak torque occurs and then "adapt" delivery at the higher rpm where there is less air per stroke. This avoids possibility of exceeding the smoke limit at the full-load, full rpm condition. Actually, "adaption" takes place in varying degrees through most of the engine's speed range.

To see how this adaption works, assume a medium speed condition (Fig. 3) and move the control lever

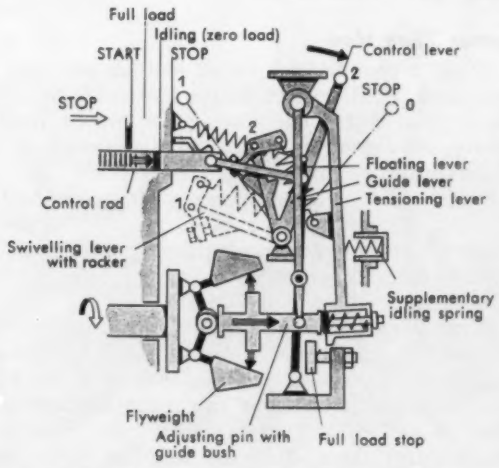


Fig. 2—Governing process in the lowest controllable speed range of the engine (idling).

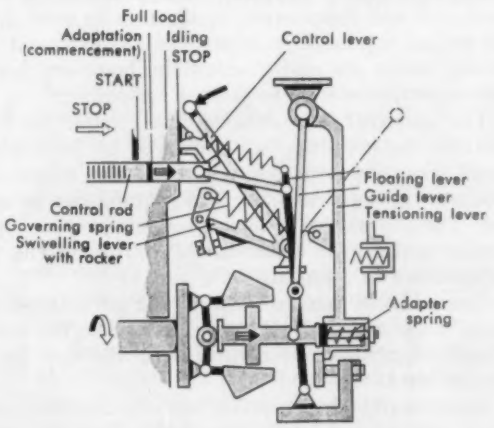


Fig. 3—Part A—Governor operation at full load, medium speed, with adaptation starting.

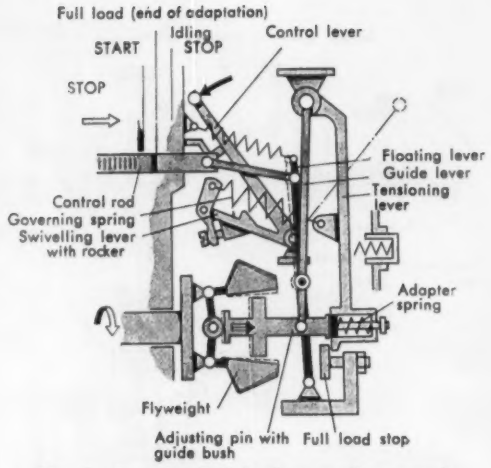


Fig. 3—Part B—Full load at medium speed, component position at end of adaptation.

to the full-load position. The governing spring is at maximum tension and the tensioning lever is pulled tight against the full-load stop. Through the levers and linkage the control rod moves to full-fuel position.

As engine speed increases, centrifugal force moves the flyweights out and consequently the adjusting pin and guide bush to the right. Centrifugal force is increasing and this results in increasing compression of the adapter spring in the torque capsule. A look at the mechanism shows that this moves the control rod gradually in the direction of reduced fuel delivery.

Should engine speed increase after the adapter spring is compressed to its stop, flyweight force continues to move the adjusting pin with guide bush to the right, moving the tensioning lever off the full-load stop. The action is to further reduce fuel delivery.

These operating descriptions have been discussed as separate and isolated actions but the fact is that all functions blend smoothly in response to engine requirements.

In Summary . . .

Robert Bosch has provided a standardized governor that nevertheless is extremely flexible. Using the same basic unit and components, application to meet different engine requirements is possible by adjustment. Adjusting screws are readily accessible; however, they do have appropriate seals to prevent tampering.

The unit that will probably find greatest use is essentially the one described. However, for less-sophisticated governing requirements, both the torque capsule and the supplementary idling spring can be omitted. There is also a minimum-maximum version with torque control, the driver having control of the rack between low idle and high idle.

One addition can be made to the governor—a separate "Stop" device. This can be used when the normal "Stop" adjusting screw is used as an idle stop for the control lever.

Functionally, the governor provides essentially constant percent regulation regardless of engine speed. It also provides a fuel delivery curve corresponding to the engine's ability to use the fuel. And it's all done with standardized component parts.

EMD . . .

(*Continued from page 28*)

Main journals are ground and then the shaft is offset in the grinder to grind each crank pin. This offset must be very accurate. Variation in radial distance will change the throw radius and hence the engine's stroke. Angular relationship between offsets for different throws must be exact and also in relationship to the flange's No. 1 pinhole that's used as a guide. EMD holds this angular relationship to within 15 minutes of No. 1 pinhole. Angular variations affect engine and individual cylinder timing.

Polishing follows grinding and produces finishes of below 10 RMS. The fillets are blended into the journal surface during polishing. Later, oil holes are also blended into the chrome surface with electric hand grinders.

Balancing Comes Next . . .

A complete shaft is necessary when balancing. This means that when half-shafts are envolved, they must first be matched and assembled. Angular relationship between the half-shafts is important as all crank throws must have a definite angular relationship.

EMD matches rebuilt half-shafts or a rebuilt half with a new half-shaft. A typical case of the latter could be a customer's shaft that had suffered damage limited to only one section. In any case, both halves are set up in a jig on a surface plate and angular relationship of the two halves established. Joining flanges are then bolted tightly through a few holes. Remaining holes are taper reamed and locked with special taper pins having retaining lock nuts. Now properly matched, and held, the same job is done on all holes.

The shaft is placed in the balancer and bob weights attached to the throws. These weights have been calculated to represent 100% of the rotating weight (rod bosses and bearings) plus 50% of the reciprocating weight (one complete rod and piston assembly). This simulates the unbalancing forces to be compensated by the counter-weights. The shaft is then balanced to within a few ounce-inches.

Better Than New . . .

When a complete job on all journals and pins has been done, EMD expects longer service life than from the original shaft. The forging has proven itself in service; the chrome is harder and stays smoother than the original hardened steel.

It offers the advantage of new-shaft standardization. There is no confusion as to bearing size and inventory problems are reduced. Incidentally, bearing clearances remain the same whether running on hardened steel or chrome.

What about cost? This will, of course, vary with the amount of work done . . . it would cost less to rebuild a single damaged bearing surface than to do the whole job. In general, a customer can realize savings in the order of 40% to 50% of new-shaft costs. When you consider that these shafts run into the $5000 range, savings are attractive . . . especially when EMD considers them better than new.

Vegas Transit cutting costs

with a low-cost Perkins diesel conversion kit

In the city famous for gambling, Vegas Transit Co., owned by Tanner Motor Tours of Nevada, Ltd., is betting on a sure thing. They've started to convert their fleet of 8M2B Marmon-Herrington city-service coaches from gasoline to diesel. All but two of the 8M2B's are relatively expensive to operate—three gal/hr of gasoline. The two exceptions have been fitted with the first installations of a new Chrysler-Perkins conversion that reduces the price premium for diesel over gasoline to remarkably narrow limits. Fuel consumption: 1½-gal/hr.

The conversions were done in neighboring Los Angeles by Crown Coach Corp., engineers and manufacturers who supply all parts for *the complete conversion* for $2000. Parts and labor, *installed*, out-the-door, $2200.

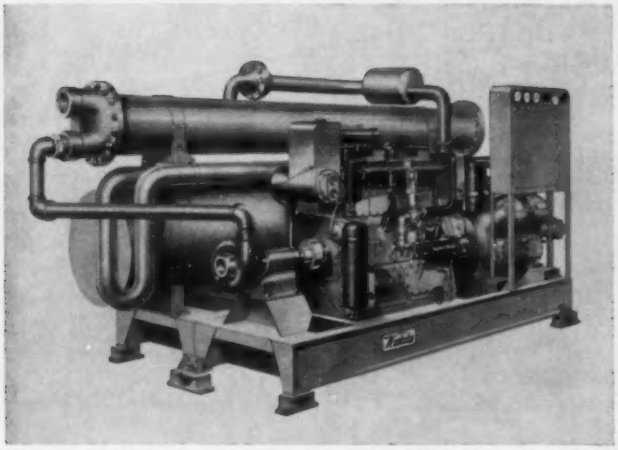
Conversion kit includes a Chrysler-Perkins 305 diesel, rated 102-hp @ 3000-rpm; adapter housing for the Spicer angle-drive transmission, with clutch release mechanism; complete exhaust system; complete water manifolding and radiator modification kit; all hoses, lines and brackets; wire loom, etc.

Crown Coach plans conversion kits for other makes of small and intermediate size motor coaches, using the Perkins engine. These conversions will be backed up by Chrysler's Marine and Industrial Division, which markets the Perkins engine. Thus, a complete stock of service parts, readily available, is assured. Parts accessability is, in the final analysis, part of the overall economy picture.

With Vegas Transit, the two buses already converted are showing marked economies over the unconverted remainder of the fleet. It started with the delivery run from Los Angeles, with an average of 11½-mpg. As Vegas Transit knew when they ordered the diesels, these savings mount up quickly.

Waukesha's new chiller

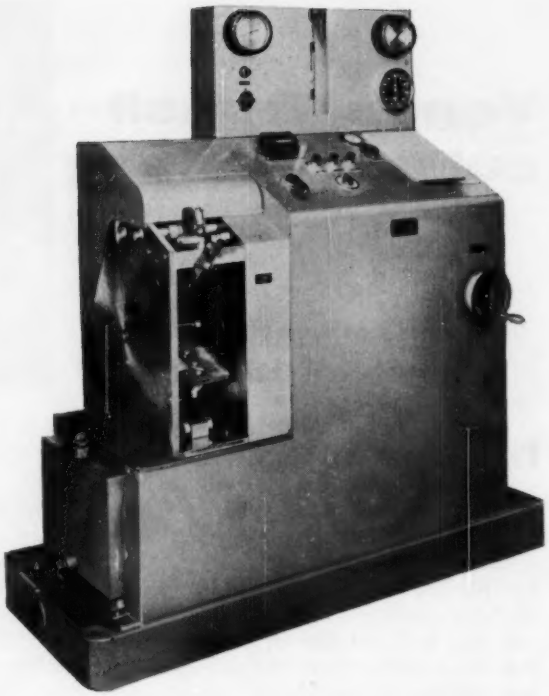
. . . a 100-ton gas air conditioning package unit



Completely packaged 100-ton air conditioning water chiller unit is first in a new series of completely integrated units that will be produced by Waukesha. Power source for these packages will be Waukesha's 140-GZ engine. The 140-GZ is a 6-cyl. natural gas engine with a bore and stroke of 4⅜ x 5½-ins. developing 144-hp @ 2000-rpm. The package is equipped with automatic controls, accessories and safety devices. Unit is tested at the factory, shipped as a sealed package to reduce installation time. In areas where natural gas is plentiful, economies of operation will be apparent. Operation is completely automatic, and there is a single control center. Accessories are grouped for servicing, sound suppression panels can be had.

diesel power

new products



Lab-Accurate Fuel-Injection Calibration

Laboratory accurate fuel injection calibration of large diesel engine injectors can be done in less time with Unitest U-8500-1A test stand. Developed primarily for GM locomotive injectors, with an eye toward lowering fuel consumption, Unitest also calibrates the same injectors on marine and stationary engines. Test stand checks fuel discharged over the entire speed range of the engine. Unitest is made by Marine Pumps, Inc., Div. of Diesel Control Corp. Illinois Auto Electric Co. of Chicago is national distributor of Unitest for the railroad industry.

232

Rockford Torque Converters

A new line of torque converters from Rockford Clutch are designed to provide infinite torque-speed ratios for off-highway vehicles, wheel and track-laying tractors, loader graders, rollers, stationary power units and industrial drives. Range is 100- to 700-hp; torque multiplication from 2.3 - 3.5:1; sizes up to 18⅜-in. diameter. Converters are single-stage 3-element type with or without automatic over-running reaction members for fluid coupling operation. Converters match Rockford's Power Shift hydraulic clutch.

233

Banana Transit

A precarious business at best, those in the business of hauling bananas know that a few degrees change in temperature and . . . the cargo is overripe before you get where you're going. Hirschbach Truck Lines of Sioux City found that Transicold had the right answer. A Perkins 4-99 diesel, rated 42.3-hp @ 3600-rpm, maintains close temperature control with complete dependability in long-haul reefers.

234

Locks Threads Up Tight

Loctite is a liquid that hardens in the threads between nut and bolt. Will not shake loose, but can be broken easily with a wrench. One of the latest uses has been found by contractors plagued by dozer downtime from loose tracks. Loctite holds the pads in place. For the asking, product information and a free sample.

235

Precision Grinding

Unitest's model U-800-A Universal grinder, developed primarily to precision grind diesel fuel pump and injector parts, is now offering attachments to grind laps or stems up to 5/8-in diameter, 9-in length. Quill drive is by speed reducer motor, which belt-rotates the part being ground.

236

Gas Meter

Roots-Connersville has added a 7000-CFH model to its line of rotary positive-displacement meters. Line-mounted, Rootesmeters are useful in production, transmission, distribution, etc, gas measurement at up to 125-psi. Meter is built to standards of compactness, easy installation, accuracy and low maintenance.

237

Long-Life Lube Filter

Baldwin Mfg. Co. has introduced a Vac-Cel Diesel Media that is money-back guaranteed to give 50% longer filter life. Guarantee includes keeping the lube oil both chemically and visually clean. According to available data, filter is extremely free flowing, does not remove or effect detergents, and offers media-migration protection.

238

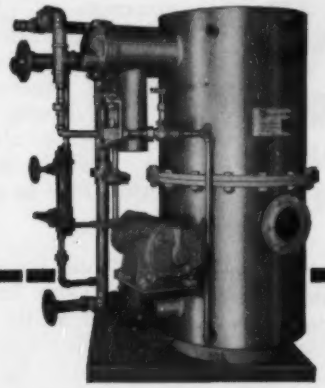
Explosion-Proof Overspeed Control Valve

Following the trend toward explosion-proof controls for natural gas engines, Amot Controls has introduced a hydraulically or pneumatically-operated overspeed control valve, either direct drive or gear driven. Speed range is 1000-3300-rpm. Basic valve is equipped with automatic valve reset, with options of manual or pneumatic reset.

239

FRESH WATER

FUEL-FREE TO DIESEL OWNERS



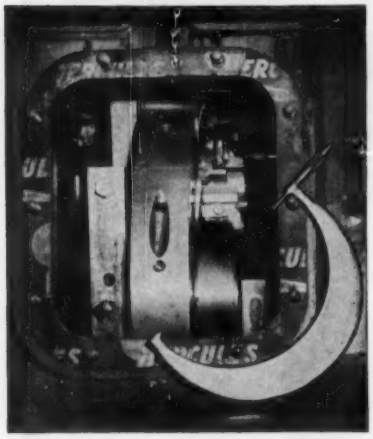
Wherever there is a diesel and a source of salt or brackish water, fresh water exceeding U.S. Public Health Service requirements can be made simply and at low cost with an AMF-Maxim Aquavap heat recovery evaporator. These evaporators, operating on engine jacket water or any other hot water source, add nothing to existing fuel costs. They are low in initial cost, inexpensive to maintain and simple to operate. They are delivered as complete packaged units, ready to install, and are extremely compact. A 1000 gallons per day Aquavap, for example, is less than 4 feet high and takes laterally about 2 x 4 feet of floor or deck space. Aquavaps are available with capacities ranging from 150 to 12,500 gallons per day.

For further details write Dept. D for the new illustrated Aquavap Bulletin.

AMF MAXIM EVAPORATOR DIVISION
American Machine & Foundry Company
WATERFORD, CONN. • Branch, DENVER, COLO.

For more information write in No. 217

WE'VE OPENED THE DOOR TO GREATER SAVINGS



Precision crank pin refinishing in place!

The small engine crank pictured above was restored in close quarters without dismantling. Our portable machines can solve your problems and save you money. Crank pins from 6" through 18" in diameter accurately refinished in place. LET US HELP YOU MINIMIZE DOWN TIME.

Damaged flywheel fits and key ways refinished in place. Bearing seats line bored and bushed to standard diameters on location. Our portable equipment is available for many other types of field repairs.

We have available facilities for transporting our equipment and personnel to most parts of the Western Hemisphere.

All types of marine and heavy power plant equipment serviced with special attention given to emergencies.

Crankshafts of any size or type completely refinished in our plant. We have the experience of more than half a century in successfully restoring broken and damaged shafts to service.

We welcome inquiries on maintenance problems requiring precision methods.

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NEW PRODUCTS . . .

Packaged Field Compressors

Clark Bros is introducing packaged field compressors to provide up to 1000-hp, mounted on a skid complete with radiator, scrubber and accessories. Length: 35-ft. "VeePac" model's engines are 2-cycle, turbocharged, integral gas-engine-driven compressors. Especially useful for any kind of field utility use.

240

Thompson Turbo

Thompson Ramo Wooldridge announces a lightweight, simple turbocharger. Production is already underway for a major producer (at this time, unnamed) of diesel engines. Designated Model 317, first deliveries have already begun. Design uses aluminum extensively, provides for ease of maintenance.

241

Clean Fuel

Fram Corp has introduced its Fuel-Gard, a filter unit that locates between the fuel oil pump and the nozzle end of the hose. Two-stage filter/separator removes water, scale, dirt and microscopic solids that accumulate in fuel tanks and storage lines, bringing fuel to U. S. Air Force standards of cleanliness.

242

Moisture Repellant

Calfonex Products have developed a spray-on formula that drives out absorbed water and moisture by penetrating and clinging to every pore, crack and scratch, forming a continuous molecular film that seals off the surface. Once on, Formula 78-A guards against further corrosion and oxydation.

243

Low-Cost Balancing

An electronic vertical single-plane balancer has been announced by Stewart-Warner. The new device uses strobe, but it is simpler and faster to operate than cradle-type devices, making production balancing economically feasible for the first time in many types of production. Four potentiometers allow settings to be "saved" for combination production/job-type work.

244

Vapor Tension Thermometer

U. S. Gauge announces series 8000 vapor tension-actuated thermometers for service as remote temperature indicators for engines, air ducts and temperature operated valves. Dial sizes are 2- 3½-in.

245

Personnel Carrier For Mining

Getman Bros. have developed a personnel carrier ideal for underground mining. Can also be used as a utility truck where low headroom is a necessity. Diesel powered, of course.

246

ASTME Tool Exposition Demonstrates Machine

At booth 1515, Tool Exposition, May, in New York, Sunnen Products will have working demonstrations of their new, more-versatile honing machine, designed for a multiplicity of jobs. If you can't make the show, use your Reader Service Card for info.

247

Solid One-Piece-Body Rocker-Arm Stamping

Laminated Shim Co. has developed a process and a product—a rocker arm cold worked into a one-piece one-stamping production operation. Good design gives high strength; stamping process reduces cost. Currently in production for farm and industrial engines.

248

Gasket Compound

Available in hard-dry or semi-hard, Seal-Last is a new gasket compound available to repair broken gaskets in the field, build up flange surfaces, or in a real emergency to substitute for no gasket at all. Both types have applicator cap.

249

Portable Power Packs

Napier Deltic Compak is a complete diesel generating plant light enough to be carried on highway trailers yet powerful enough to supply the complete power needs of small towns. Lightness is due to relatively-small high-rpm engines. Four models are offered from 1200 to 3000-kW, in single units.

250

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- ☐ Railroad Transportation
- ☐ Lumber & Logging
- ☐ Mining & Quarrying
- ☐ Municipal Power Plant
- ☐ Utility Power Plant
- ☐ Consulting Engineering
- ☐ Engine or Equipment Manufacturer
- ☐ Engine or Equipment Distributor
- ☐ Engine or Equipment Service and Repair

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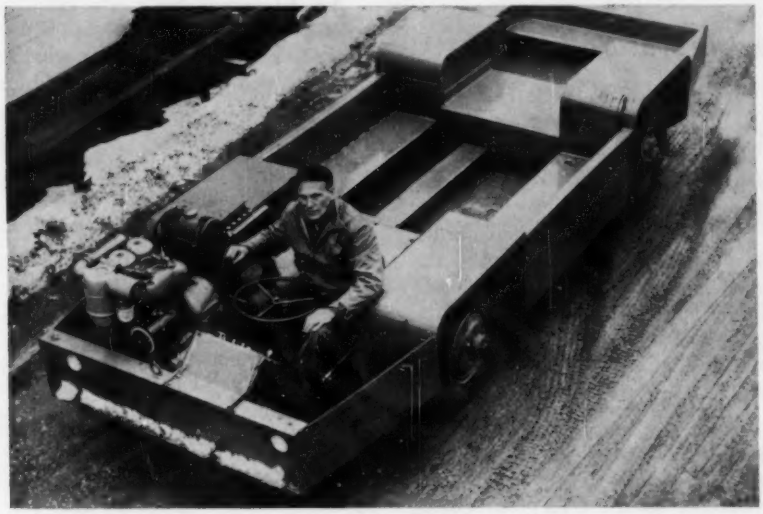

Personnel Carrier for Underground Mining
A personnel carrier for underground mining, construction and other industrial uses where low-headroom is a problem has been developed by Getman Brothers. Power is supplied by a Deutz air-cooled engine. Can also double as a utility truck. Four-wheel-drive; speed up to 20-mph; carrying capacity up to 5000-lb.
272

Marmon-Herrington Tilt-Cab Tractor
M-H's HDT-1 tilt-cab (GVW 43,000; GCW 72,000) is fitted with a Cummins NH-195 naturally-aspirated diesel engine, rated 195-hp @ 2100-rpm. Fuller Roadranger R96 gearbox is driven through 14-in. 2-plate clutch. Propeller shaft is Spicer 1700; rear driving axle is Timken R-140 (ratio 4.11 or 4.62). Tandem suspension is by Page & Page.
273

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251

On Torque Converters

Clark has issued a 2-color 4-page folder describing new 12- and 13-in. wheel C270 industrial torque converters, input capacities to 125-hp and 270-lb/ft torque, for loaders, crawlers, tractors, etc.

252

White Dragline, Shovel Applications

White Superior has issued a bulletin describing construction features, supercharging, operation on non-premium fuels, engineering data, specs, performance and fuel-consumption charts. Write for bulletin 125.

253

Reduced Voltage Motor Controls

Electric Machinery's pub. #3100-PRD-202 describes a line of magnetic low-voltage synchronous motor controls using auto-transformer or part-winding starting, both methods using kva reduction. Shows dimensions, weights, construction details.

254

Up-Dating on Controls

Amot Controls has a new catalog assembled to bring the-man-who-needs-to-know up-to-date on what's available, and what's been done. One section treats of advancement in the field of controls; another of Amot's vibration valve.

255

Lift-Truck Line

Allis-Chalmers line of lift trucks in the 2000—10,000-lb capacity range is described in a 16-page catalog, complete with photographs, specs, performance graphs, etc. This line is available in LP or diesel, and for light-duty, gasoline.

256

Blotter Technique

W. G. B. Oil Clarifier, Inc. are offering a pocket-size folder with a blotter section to periodically check lube oil condition relative to filter condition. Can be carried in the glove box of any vehicle for reference.

257

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Fulton-Sylphon (Robertshaw) has a wholly integrated engine safety system, but they also supply individual components separately. Engine safety controls of some kind are necessary for every installation, even if just a simple gage. Whatever the size or complexity of your installation, Fulton-Sylphon's catalog has answers that may help you to do it better. Catalog is free.

258

Spiral-Wound Gasket Catalog Set

Flexitallic Gasket Co. has prepared a beautifully-done and complete cataloging of their spiral-wound gaskets line. Includes asbestos gaskets and a special section on Teflon. In addition, many schematic drawings of general interest to mechanical people are included. These are sections of gasket applications, which will be of assistance to anyone who ever finds it necessary to join flanges or create a seal of any kind. This beautiful catalog set is free for the asking.

259

Get In The Groove!

If you're the man responsible for piston ring selection and replacement this 8-pager by Piston Products is for you. Entitled "Get In The Right Groove", it covers application of rings in large bore engines, and many compensating factors for ordinary wear. Free on request.

260

Vibration Book

Only in recent years has the problem of vibration become critical. But the fact is it has. High and low frequency vibrations cause mechanical damage and are one cause of fatigue failures. "Vibration Control Data Book," free for the asking from Vibration Mountings and Controls, Inc., is loaded with information on muffling vibration in everything from lighting fixtures to compressors. Ask for a copy.

261

Revised Fuel Specs for GM Series 53, 71, 110

Revised fuel and lubricating oil specs for the above series engines have been published by General Motors Diesel Limited, London, Ontario, Canada. Useful engine life of all engines between overhauls is greatly influenced by the fuels and lubes used. Send for a copy.

262

Low-Resistance Oil-Bath Air Cleaner

American Air Filter Co. has released a bulletin describing its Model C Type P Cycoil industrial oil-bath air cleaner, with pneumatic oil lift. Contains complete information, with detailed drawings, dimensions, resistance curves and instructions.

263

Yesterday to Tomorrow

Kurz and Root Company have prepared a 16-page two-color brochure describing their design, manufacturing and engineering facilities. The company builds generator sets, available with diesel engines, of course and other components. Title of brochure: "Yesterday, Today and Tomorrow".

264

On Turbo Application

Men who have responsibility for turbocharger selection and installation maintenance can get a lot of background by reading "Turbocharging", magazine of the Garrett Corp's AiResearch Division. If qualified, you may get on the mailing list.

265

Bendix Filter Div.

A six-page two-color tech bulletin is offered by Bendix Filter Div. discussing commercial and military filter-water separators and conversion kits. Covers operating principles as well as dimensional and flow specs on 13 separators and kits. List of units that can be converted is supplied.

266

On Bronze and Bushings

A brochure by Markey Bronze Bushing Co. lists the 20 popular SAE brass and bronze alloys, their chemical composition and physical properties. If you work with these metals, send for a copy.

267

GM 53 Booklet

Operators of small trucks and light highway tractors who wonder whether diesel is the answer to high operating costs will find the answer in "Why Diesels for Small Trucks". Booklet contains operations reports on GM series 53 engines. No charge.

268

Technical Study on Improved Performance And Longer Engine Life

An informative technical study of engine performance and engine life, relative to ring seating and distribution of compression pressure over more than the top ring, is available for the asking from C. Lee Cook. The answers found in the booklet are saving dollars for many users who have had poor performance and high maintenance because of ring problems. There's a lot of good background information to boot.

269

For High Operational Efficiency

Many users who found that engines seemed to pull power and rpm in the shop, but didn't quite come up to standard in service, have answered their problems with a dynamometer. A dynamometer runs in and tests an engine for rated power at specified rpm. Long a tool where performance is mandatory (such as racing), the dynamometer is paying its way in today's commercial applications, where downtime is costly and poor performance even more costly.

At no charge, complete engine performance data and details on dynos are available from Clayton. Their concept of "road testing" in the shop may provide an answer.

270

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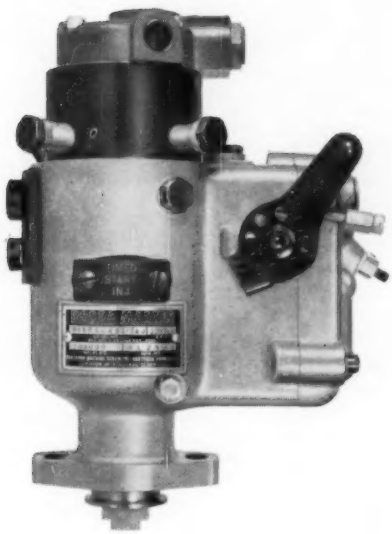

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